TESIS DE LA UNIVERSIDAD DE ZARAGOZA
2021
153

José Luis Espinoza Delgado

Essays on multidimensional poverty measurement: moving from the household to the individual, with evidence from Nicaragua and Central American countries

Director/es
Klasen, Stephan
López Laborda, Julio

ISSN 2254-7606

Prensas de la Universidad
Universidad Zaragoza

ISSN 2254-7606

Universidad Zaragoza
1542

Tesis Doctoral

ESSAYS ON MULTIDIMENSIONAL POVERTY MEASUREMENT: MOVING FROM THE HOUSEHOLD TO THE INDIVIDUAL, WITH EVIDENCE FROM NICARAGUA AND CENTRAL AMERICAN COUNTRIES

Autor

José Luis Espinoza Delgado

Director/es

Klasen, Stephan
López Laborda, Julio

UNIVERSIDAD DE ZARAGOZA
Escuela de Doctorado

2019

Essays on multidimensional poverty measurement: moving from the household to the individual, with evidence from Nicaragua and Central American countries

Dissertation in order to acquire the doctoral degree from the Faculty of Business and Economics, at the Georg-August-Universität Göttingen, and from the Faculty of Economics and Business, at the University of Zaragoza, under a Cotutelle Agreement between Georg-August-Universität Göttingen and the University of Zaragoza

Submitted by

José Luis Espinoza Delgado

Born in León, Nicaragua

Universidad Zaragoza

March 2019

First Supervisor:
Professor Stephan Klasen, Ph.D.
Professor of Economics
Chair of Development Economics
Department of Economics
Georg-August-Universität Göttingen

Second Supervisor:
Professor Dr. Julio López-Laborda
Professor of Economics
Department of Structure and Economic History and Public Economy
University of Zaragoza

Third Supervisor:
Professor Dr. Thomas Kneib
Professor of Statistics
Chair of Statistics
Department of Economics
Georg-August-Universität Göttingen

Examining Committee:

Professor Stephan Klasen, Ph.D.
Professor of Economics
Chair of Development Economics
Department of Economics
Georg-August-Universität Göttingen

Professor Dr. Luis Ayala Cañón
Professor of Economics
Department of Economics
King Juan Carlos University

Professor Dr. Thomas Kneib
Professor of Statistics
Chair of Statistics
Department of Economics
Georg-August-Universität Göttingen

Professor Jacques Silber, Ph.D.
Professor of Economics
Department of Economics
Bar-Ilan University

To my children, José and Rebeka

To my wife, Francis Rosario

To my parents, Braulio and María (†)

Contents

List of Tables

List of Figures

Resumen

La pobreza es quizás la principal fuente de falta de libertad (Sen, 2000a), y puede implicar no solo la ausencia de necesidades materiales, sino también la negación de oportunidades para llevar una vida digna; este problema social es, en muchos sentidos, la peor forma de privación humana (Anand & Sen, 1997, p. 4). Por consiguiente, la eliminación de la pobreza es una de las preocupaciones centrales del desarrollo en el mundo, incluso en la segunda década del siglo XXI (Chakravarty, 2018; Chakravarty & Silber, 2008), y representa, de hecho, el mayor desafío global y un requisito indispensable para el desarrollo sostenible (UN, 2017, pág. 1).

En consecuencia, la Agenda 2030 para el Desarrollo Sostenible, un marco normativo con consenso internacional, aprobada en 2015, ha puesto especial énfasis en esa difícil tarea (UN, 2015b), y el primer objetivo de los Objetivos de Desarrollo Sostenible (ODS) exige el fin de la pobreza en todas sus formas en todas partes (UN, 2015b, p. 15). En este contexto, tal como señala Deaton (2016, p. 1221), la medición de la pobreza, la principal preocupación en esta tesis, es de gran importancia para la focalización y el seguimiento de las políticas diseñadas para el alivio de la pobreza, y es necesaria, si no suficiente, para una evaluación razonada de dichas políticas.

Según Thorbecke (2008, p. 4), antes de que se pueda medir la pobreza, esta tiene que ser al menos comprendido conceptualmente. En esta línea, nuestra comprensión conceptual de la pobreza se ha mejorado y profundizado notablemente en las últimas cuatro décadas aproximadamente, debido en gran parte al seminal trabajo de Amartya Sen y su marco teórico de "capacidades y funcionamientos" o "enfoque de capacidades" (Sen, 1984, 1985, 1992, 1993, 2000a, 2008), por lo que este marco conceptual representa el punto de partida lógico en un intento por capturar el concepto de pobreza. De acuerdo con este enfoque, la pobreza se define como la "privación de capacidad", lo que implica, como lo señala Sen (2000a, pág. 87), concentrarse en las privaciones que son intrínsecamente significativas, a diferencia de un bajo ingreso que solo es importante desde el punto de vista instrumental; así, la pobreza se considera como un fenómeno multidimensional: las vidas humanas, como subraya Sen (2000b, pág. 18), son golpeadas y disminuidas de diferentes maneras.

Merece la pena advertir, sin embargo, que el enfoque de capacidad enfrenta en la práctica el engorroso problema de que la "dotación de capacidad" de un individuo no puede medirse *ex ante* y, dentro de los límites, solo sus "funcionamientos alcanzados" (resultados) pueden ser medidos *ex post* (Thorbecke, 2008). Por lo tanto, aunque esta tesis se enmarca

conceptualmente dentro de este enfoque, solo podrá evaluar el estado de pobreza multidimensional mediante la observación de los "funcionamientos reales" (alcanzados). En otras palabras, esta tesis seguirá un enfoque pragmático, a diferencia de uno filosófico, cuando analice la pobreza multidimensional.

Considerando el enfoque influyente de Sen, en la actualidad existe un consenso generalizado de que la medición de la pobreza no debe basarse únicamente en el ingreso, ya que este indicador monetario no puede incorporar, ni reflejar, las dimensiones claves de la vida humana como, por ejemplo, esperanza de vida, falta de educación, desempleo, provisión de bienes públicos, refugio inadecuado, entre otras (Atkinson, 2003; Bourguignon & Chakravarty, 2003; Chakravarty, 2018; Chakravarty & Lugo, 2016; Kakwani & Silber, 2008a; Stiglitz, Sen , & Fitoussi, 2009a, 2009b). A partir de este reconocimiento, en los últimos quince años, o más o menos, la medición de la pobreza ha cambiado el énfasis y ha pasado de un enfoque de análisis unidimensional a uno multidimensional, lo que ha sido considerado como el aporte más significativo de la investigación sobre pobreza en los últimos años (Kakwani y Silber, 2008a), y diferentes metodologías de medición, así como diferentes índices de pobreza multidimensional, se han vuelto cada vez más populares (Duclos y Tiberti, 2016).

En la actualidad, la metodología dominante ("la corriente principal") para la medición de la pobreza multidimensional en los países en desarrollo es el "enfoque de conteo" propuesto por Alkire y Foster (2011a), en gran parte debido al trabajo extraordinario realizado por la Iniciativa de Pobreza y Desarrollo Humano de Oxford (OPHI, por sus siglas en inglés). En 2010, esta institución, en colaboración con el Programa de las Naciones Unidas para el Desarrollo (UNDP, por sus siglas en inglés), desarrolló el índice de pobreza multidimensional global ("MPI global"), la aplicación empírica más famosa e influyente de la metodología de Alkire y Foster, calculado para más de 100 países en desarrollo (Alkire y Santos, 2010, 2014). Desde 2010, este índice forma parte del Informe sobre Desarrollo Humano del PNUD (UNDP, 2010), y está empezando a verse como un serio competidor para el indicador de pobreza monetaria ("$ 1.90 al día") del Banco Mundial (Klasen, 2018, p. 2). Asimismo, varios países, particularmente de América Latina y el Caribe, han adoptado la metodología de Alkire y Foster para producir sus medidas oficiales de pobreza multidimensional.

La metodología de Alkire y Foster es una familia de medidas de pobreza multidimensional que emplea un "método de doble corte" para la identificación de los multidimensionalmente pobres, y las medidas de pobreza FGT (Foster-Green-Thorbecke), ajustadas adecuadamente, para la agregación de la información de los pobres (Alkire & Foster, 2011a). Esta metodología ciertamente satisface un sinnúmero de propiedades interesantes, además de ser flexible, clara y sencilla, en comparación con otras metodologías para la medición de la pobreza multidimensional (Silber, 2011; Thorbecke, 2011); sin embargo, tal como lo señalan Duclos y Tiberti (2016), dicha metodología también presenta algunos inconvenientes metodológicos, no muy atractivos y que no han sido suficientemente observados en la literatura, que podrían llevar a estimaciones sesgadas y evaluaciones erróneas de la pobreza multidimensional general en la sociedad. De particular interés para esta tesis es el hecho de que cuando solo se cuenta con variables ordinales para el análisis, el caso más común en la práctica, las medidas derivadas a partir de la aplicación de la metodología de Alkire y Foster no toman en cuenta la distribución de las privaciones y, consecuentemente, los índices resultantes son insensibles a la desigualdad entre los individuos multidimensionalmente pobres (Datt, 2018; Rippin, 2013, 2017). Esta debilidad metodológica es un defecto grave de cualquier medida de pobreza, según los argumentos influyentes de Sen (1976, 1979, 1992) de que los índices de pobreza deben ser sensibles a la desigualdad, y puede llevar a "dejar atrás a los más pobres entre los pobres", desafiando, por lo tanto, la preocupación central de la agenda de los ODS: "no dejar a nadie atrás" (Klasen y Fleurbaey, 2018).

En lo que se refiere al trabajo empírico, en la literatura se observa que la gran mayoría de los estudios ("la práctica general") preocupados por la medición de la pobreza multidimensional utiliza el "hogar", en lugar del "individuo", como unidad de análisis, lo que significa que estos trabajos equiparan la condición de pobreza multidimensional del hogar con la condición de pobreza multidimensional de todos los individuos que pertenecen a dicho hogar, ignorando, por lo tanto, las desigualdades dentro del hogar, y generando índices insensibles al género.

Pero, tal como lo observa Deaton (1997, p. 223), la pobreza es una característica de los individuos, no de los hogares, y si uno considera "en serio" el objeto final del análisis de bienestar, es decir, el bienestar de los individuos, limitar el análisis teórico y empírico a nivel del hogar es simplemente inaceptable (Chiappori, 2016, p. 840), ya que las medidas basadas

en el hogar podrían proporcionar estimaciones sesgadas de la extensión de la pobreza multidimensional: por ejemplo, si las mujeres son sistemáticamente más pobres que los hombres, o si los niños y los ancianos están sistemáticamente en peor situación que otros miembros del hogar, la pobreza general podría subestimarse cuando uno emplea una medida que trata por igual, en términos de pobreza, a todos los miembros en el hogar (Deaton, 1997); además, cuando se usan medidas de pobreza basadas en el hogar, se podría pasar por alto información valiosa sobre la composición de los pobres multidimensionales (Jenkins, 1991), lo que puede afectar la focalización y la eficacia de las políticas de alivio de la pobreza (véase, por ejemplo, Brown, Ravallion, & van de Walle, 2018). Por lo tanto, las medidas de pobreza multidimensional basadas en el hogar no son "confiables" en el mejor de los casos (Chiappori y Meghir, 2015, p. 1371), y podrían no ser adecuadas para monitorear el progreso en el logro de la meta 1.2 de los ODS: reducir al menos a la mitad la proporción de hombres, mujeres y niños de todas las edades que viven en pobreza en todas sus dimensiones según las definiciones nacionales (UN, 2015, pág. 15).

En consecuencia, considerando las brechas observadas en la literatura y la agenda actual de desarrollo sostenible, esta tesis contribuye a los temas abiertos en la literatura sobre el análisis multidimensional de la pobreza y desafía la práctica actual en los países en desarrollo. Su objetivo, en general, es investigar cuestiones de vanguardia en la medición de la pobreza y proporcionar nuevos conocimientos sobre el análisis de la pobreza multidimensional, con evidencia empírica sobre Nicaragua y sobre otros países centroamericanos, donde viven las personas más pobres de América Latina y el Caribe (Duryea & Robles, 2007; Santos & Villatoro, 2018). Dado que la mayoría de las medidas de pobreza multidimensional existentes en los países en desarrollo utiliza el hogar como unidad de identificación de los pobres, esta tesis propone cambiar el foco del análisis y pasar del hogar al individuo, para tratar de capturar algunas de las desigualdades que se producen dentro del hogar y obtener medidas de pobreza multidimensional sensibles al género. Esta tesis es una colección de ensayos independientes, comprende cuatro ensayos, los cuales se resumen brevemente a continuación.

El ensayo 1 (sección 2 de esta tesis), que se basa en un trabajo conjunto con Julio López-Laborda, se ocupa de estimar la pobreza multidimensional en Nicaragua y de evaluar la evolución de la incidencia, la intensidad y la severidad de la pobreza multidimensional en este país centroamericano entre 2001 y 2009. El ensayo utiliza un índice basado en el hogar

para comparar, apropiadamente, la evolución de la pobreza multidimensional en Nicaragua con las cifras oficiales de pobreza en este país (un enfoque monetario), otro objetivo específico del ensayo 1. Dado que Nicaragua, el país más pobre de América Latina y el Caribe (Duryea y Robles, 2007; Santos y Villatoro, 2018), sigue un enfoque monetario para producir su medida oficial de pobreza, el ensayo 1 enfatiza en la necesidad de adoptar un enfoque más amplio de medición de la pobreza en ese país y ofrece evidencia empírica sustancial que respaldaría dicha decisión. En general, encontramos que la incidencia, la intensidad y la gravedad de la pobreza multidimensional en Nicaragua disminuyeron entre 2001 y 2009, particularmente entre 2001 y 2005. También encontramos que tanto el enfoque monetario como el multidimensional muestran que la proporción de pobres en Nicaragua declinó entre 2001 y 2009; sin embargo, un análisis separado de cada uno de los sub-períodos reveló una gran disparidad entre un enfoque y el otro.

Dado que la pobreza es una característica de los individuos, no de los hogares, y el uso del hogar como unidad de análisis pasa por alto importantes características internas del hogar e ignora las desigualdades que se generan dentro de los hogares, el ensayo 2 (sección 3 de esta tesis), que se basa en un trabajo conjunto con Stephan Klasen, tiene como objetivo dar un paso adelante en la medición de la pobreza multidimensional, abrir la "caja negra" que es el hogar (Jenkins, 1991, p. 457), y proponer un marco de análisis basado en el individuo, para superar algunas de las deficiencias de las medidas de pobreza multidimensional existentes, que están basadas en el hogar. Empleando datos de Nicaragua (año 2014), usamos el marco propuesto para estimar la pobreza multidimensional de los individuos y la desigualdad, así como las brechas de género correspondientes en este país. Aplicamos la metodología propuesta por Alkire y Foster (2011a) y el "índice de pobreza sensible a la correlación" (CSPI, por sus siglas en inglés) propuesto por Rippin (2013, 2016, 2017), el cual es un índice de pobreza multidimensional sensible a la desigualdad, así como la medida de desigualdad absoluta propuesta por Alkire y Seth (2014a). Adicionalmente, exploramos los determinantes de la pobreza multidimensional en Nicaragua mediante la estimación de modelos de regresión Logit. Cabe destacar que Nicaragua es un caso de estudio interesante porque es, como se mencionó anteriormente, el país más pobre de América Latina y el Caribe (Duryea & Robles, 2017; Santos & Villatoro, 2018) y, al mismo tiempo, según el Índice Global de Brechas de Género 2017, es el país con mejor desempeño en esa región por sexto año consecutivo (World Economic Forum, 2017).

En el ensayo 2, en general, proporcionamos importante evidencia en apoyo de un análisis más desagregado de la pobreza multidimensional, ya que los resultados muestran que la incidencia y la desigualdad de la pobreza multidimensional pueden ser muy diferentes para diferentes grupos de edad en la sociedad. En particular, encontramos que en Nicaragua, la incidencia multidimensional de la pobreza sigue siendo un problema de gran calado y el enfoque monetario parece ser incapaz de revelar el alcance de la misma. Así mismo, la intensidad de la pobreza multidimensional es también una gran preocupación en este país: las personas pobres en múltiples dimensiones sufren, en promedio, de privaciones en más del 50% de los indicadores considerados en el análisis.

Cabe destacar, sin embargo, que en el ensayo 2 encontramos que cuando se usa un índice con tres dimensiones (educación, salud y nivel de vida), la pobreza multidimensional en Nicaragua no parece estar feminizada, y se estima que las brechas de género son inferiores al 5%: las mujeres están ligeramente mejor que los hombres en términos de la incidencia de la pobreza multidimensional (4%) y el índice MPI (2%), mientras que lo contrario ocurre para el caso de la intensidad (2%). No obstante, la desigualdad entre los multidimensionalmente pobres, un tema que también ha sido descuidado por la mayoría de los trabajos empíricos existentes, está claramente feminizada, especialmente entre los adultos. Además, tal como sospechan Bradshaw, Chant y Linneker (2017a), encontramos que la incorporación en el análisis de una cuarta dimensión, en la cual las mujeres enfrentan una mayor privación, conduce a mayores estimaciones de la incidencia, intensidad y desigualdad de la pobreza multidimensional de la mujer. Este hallazgo sugiere que las evaluaciones de la pobreza multidimensional relativa de las mujeres pueden depender de qué se mide y de cuáles dimensiones de la pobreza se incluyen en las evaluaciones (Bradshaw et al., 2017a, 2018).

El ensayo 3 (sección 4 de esta tesis), que se basa en un trabajo conjunto con Jacques Silber, también propone apartarse un poco del "enfoque general o corriente principal" para la medición de la pobreza multidimensional, así como de la "práctica general", y sugiere adoptar un enfoque basado en el individuo y sensible a la desigualdad, cuando solo están disponibles variables ordinales (el caso más común en la práctica). Basándonos en el marco general propuesto por Silber y Yalonetzky (2014) y en la metodología de Rippin (2013, 2017), en el ensayo 3, sugerimos la adopción de una función de identificación "borrosa" que especifica explícitamente el tipo de relación existente entre las variables ordinales consideradas en el análisis, eliminando así algunas de las ambigüedades del enfoque de

Alkire y Foster, y una clase de medidas de pobreza multidimensional que tiene la ventaja de tomar en cuenta consideraciones de eficiencia y justicia distributiva (Rippin, 2013, 2017), y que también puede descomponerse en las "tres dimensiones" de la pobreza: incidencia, intensidad y desigualdad (Jenkins y Lambert, 1997). Utilizamos el marco sugerido en el ensayo 3 para analizar la pobreza multidimensional en cinco países de América Central (entre las personas de 18 y 59 años de edad), a saber, Guatemala, El Salvador, Honduras, Nicaragua y Costa Rica. En general, en el ensayo 3, encontramos que las personas que viven en Guatemala tienen la mayor probabilidad de ser pobres en múltiples dimensiones, seguidas por las que viven en Nicaragua. También encontramos que en América Central la incidencia y la intensidad de la pobreza multidimensional son mayores entre las mujeres, mientras que la desigualdad de la pobreza es algo mayor entre los hombres.

El ensayo 4 complementa empíricamente el ensayo 3 y enfatiza, de nuevo, la necesidad de apartarse de alguna manera del enfoque general para la medición de la pobreza multidimensional en los países en desarrollo, considerando, en particular, la preocupación central de la Agenda de Desarrollo Sostenible 2030, "sin dejar a nadie atrás", y las metas 1.2 y 10.1 de los ODS. El ensayo señala que la práctica actual para la medición de la pobreza multidimensional en los países en vías de desarrollo es deficiente para monitorear adecuadamente el progreso en la reducción de la pobreza, principalmente porque utiliza el hogar como unidad de análisis, ignorando así las desigualdades dentro del hogar, y porque es totalmente insensible a la desigualdad entre los individuos multidimensionalmente pobres. Sobre la base del ensayo 3, en el ensayo 4 proponemos, consecuentemente, la adopción de un enfoque centrado en la persona y sensible a la desigualdad para monitorear el progreso en la reducción de la pobreza multidimensional, en el contexto del objetivo 1 de los ODS y en línea con la preocupación central de la agenda de los ODS (Klasen y Fleurbaey, 2018); utilizamos dicho enfoque para evaluar el progreso en la reducción de la pobreza multidimensional en Nicaragua entre 2001 y 2014.

En general, el Ensayo 4 revela hallazgos interesantes que refuerzan el argumento de que se requiere una medida sensible a la desigualdad para monitorear adecuadamente el progreso en la reducción de la pobreza multidimensional, ya que la desigualdad puede ser un problema no neutral (y no menor) en el tiempo, particularmente en regiones como Latinoamérica y el Caribe (véase, por ejemplo, ECLAC, 2018a); en otras palabras, el Ensayo 4 muestra que la desigualdad entre los individuos multidimensionalmente pobres es

importante y debe incorporarse en el análisis multidimensional de la pobreza. Encontramos que en Nicaragua, la pobreza multidimensional disminuyó en al menos un 17% entre 2001 y 2014, pero el progreso observado no se logró de manera uniforme. Por otro lado, encontramos que la desigualdad entre los pobres aumentó en al menos un 24% durante el período de análisis, lo que sugiere que el progreso en la reducción de la pobreza multidimensional en Nicaragua parece estar dejando atrás a los más pobres entre los pobres, lo que desafía la preocupación central de la agenda de los ODS.

1. Introduction and overview

Poverty is perhaps the major source of unfreedom (Sen, 2000a). It can entail not only the absence of necessities of material well-being but also the negation of opportunities of living a decent life; it is, in many ways, "the worst form of human deprivation" (Anand & Sen, 1997, p. 4). The removal of poverty is consequently one of the central concerns of development in the world, even in the second decade of the twenty-first century (Chakravarty, 2018; Chakravarty & Silber, 2008); it is actually "the greatest global challenge and an indispensable requirement for sustainable development" (UN, 2017, p. 1).

Accordingly, the 2030 Agenda for Sustainable Development, a normative framework with international consensus, which was passed in 2015, has put particular emphasis on this difficult task (UN, 2015b), and Goal 1 of the Sustainable Development Goals (SDGs) demands the ending of "poverty in all its forms everywhere" (UN, 2015b, p. 15). In this context, as noted by Deaton (2016, p. 1221), the measurement of poverty, the major preoccupation in this dissertation, can be of great significance for the targeting and monitoring of policies that are advocated for the alleviation of poverty, even without comprehending its mechanisms; it is necessary if not sufficient for any reasoned evaluation of those policies and "can be of tremendous practical relevance" (Alkire & Foster, 2011b, p. 290).

As observed by Thorbecke (2008, p. 4), before poverty can be measured, it has to be at least grasped conceptually. In this line, our conceptual understanding of poverty has improved and deepened notably in the last four decades or so, due in large part to the seminal work of Amartya Sen and his theoretical framework of "capabilities and functionings" or "capability approach" (Sen, 1984, 1985, 1992, 1993, 2000a, 2008),[1] so this framework represents "the most comprehensive and therefore logical starting point in an attempt to capture the concept of poverty". Under the capability approach, poverty is defined as capability deprivation, which implies, as remarked by Sen (2000a, p. 87), concentrating on deprivations that are *intrinsically* significant, unlike low income that is only *instrumentally*

[1] According to Sen (2000a, p. 75), "functionings" are "the various things a person may value doing or being. The valued functionings may vary from elementary ones, such as being adequately nourished and being free from avoidable disease, to very complex activities or personal states, such as being able to take part in the life of the community and having self-respect. A person's capability refers to the alternative combinations of functionings that are feasible for her to achieve. Capability is thus a kind of freedom: The substantive freedom to achieve alternative functioning combinations (or, less formally put, the freedom to achieve various lifestyles). For example, an affluent person who fasts may have the same functioning achievement in terms of eating or nourishment as a destitute person who is forced to starve, but the first person does have a different "capability set" than the second (the first *can* choose to eat well and be well nourished in a way the second cannot)".

important; poverty is thus regarded as a multidimensional phenomenon: Human lives, as stressed by Sen (2000b, p. 18), "are battered and diminished in all kinds of different ways".

The capability approach, however, faces in practice the cumbersome issue that the individual's capability endowment cannot be measured *ex ante* and, within limits, only achieved functionings (outcomes) can be measured *ex post* (Thorbecke, 2008). Therefore, although this dissertation is conceptually framed within this approach, it will be only able to appraise the state of multidimensional poverty from observing the actual (achieved) functionings. In other words, it will follow a pragmatic approach, as opposed to a philosophical one, when measuring multidimensional poverty.[2]

Considering Sen's influential approach, there is, nowadays, a widespread consensus that poverty measurement should not be based solely on income (or consumption expenditure) as this monetary indicator cannot incorporate and reflect key dimensions of human life such as, for example, ill health, life expectancy, lack of education, unemployment, the provision of public goods, inadequate shelter and so on (Atkinson, 2003; Bourguignon & Chakravarty, 2003; Chakravarty, 2018; Chakravarty & Lugo, 2016; Kakwani & Silber, 2008a; Stiglitz, Sen, & Fitoussi, 2009a, 2009b).[3] As a result of this awareness, over the last fifteen years or so, the measurement of poverty has shifted the emphasis from a uni- to a multidimensional approach, which has been considered as the most significant development of poverty research in recent years (Kakwani & Silber, 2008a), and different multidimensional poverty methodologies, as well as multidimensional poverty indices, have

[2] "A pragmatic, as opposed to a philosophical, approach would argue that it is the actual outcome that matters and that, in any case, *ex ante* capability cannot be ascertained. Poverty analysts can only judge the state of poverty from observing the actual functioning. The fact that a person or a household has the means to avoid deprivation does not alter an outcome marked by malnutrition and ill-health. If the actual state of living is one of poverty in at least some of its dimensions, the fact that it could have been avoided by the choice of a different allocation of income and other attributes by a given individual does not affect the prevailing state of poverty" (Thorbecke, 2008, p. 5).

[3] As emphasized by Thorbecke (2008, p. 4-5), "the use of income to pinpoint poverty presupposes that a market exists for all attributes and that prices reflect the utility weights all households within a specific setting assign to these attributes"; but, "some (non-monetary) attributes cannot be purchased because markets do not exist, for example, with some public goods". "Another drawback of using the income approach to capture poverty is that even if it were possible to specify the minimum thresholds of each and every basic need and put a price tag on them and aggregate across minimum thresholds to derive the monetary poverty line, there is no guarantee that individuals with incomes at –or even above- the poverty line would actually allocate their incomes so as to purchase the minimum basic needs bundle". For instance, there are examples of household heads who receive an income above the poverty line and allocate it to satisfy wants for alcohol and tobacco at the expense of satisfying the minimum caloric requirements for their children. In the money-metric approach, such households would be classified as non-poor whereas in reality at least some of their members are deprived of some basic needs and therefore should be considered poor".

become increasingly popular (Duclos & Tiberti, 2016).[4] Yet, there does not seem to be a universal consensus about whether to bring together the multiple dimensions of poverty into a composite index or, instead, to use a dashboard approach (Lustig, 2011; Ravallion, 2011). It is argued in this thesis, however, that there are no reasons to choose between both approaches, as the latter is useful for the design of social policies, especially after identifying the multi-dimensionally poor individuals, while the former is helpful to take advantage of the information from the joint distribution of deprivations, particularly when the aim is to quantify the incidence of many deprivations for the same individuals.

Currently, the dominating multidimensional poverty methodology ("the mainstream approach") in developing countries is the counting approach proposed by Alkire and Foster (2011a), largely due to the extraordinary work done at the Oxford Poverty and Human Development Initiative (OPHI).[5] In 2010, this institution, in collaboration with the United Nations Development Program (UNDP), developed the global MPI, the most famous and influential empirical application of the Alkire and Foster's methodology, computed for over 100 developing countries (Alkire & Santos, 2010, 2014). Since 2010, the global MPI has been incorporated into the Human Development Report of the UNDP (UNDP, 2010), and it is beginning to be seen as a "serious competitor to the World Bank's $1.90-a-day monetary poverty indicator" (Klasen, 2018, p. 2). Likewise, several countries, particularly from Latin America and the Caribbean,[6] have adopted that methodology to produce their official multidimensional poverty measures.

The Alkire and Foster's approach is an axiomatic family of multidimensional poverty measures that employs a dual cutoff method for the identification of the poor and the FGT (Foster-Green-Thorbecke) poverty measures for the aggregation of the information of the multi-dimensionally poor, which are suitably adjusted to account for multidimensionality, (Alkire & Foster, 2011a). This methodology certainly has quite a nice number of interesting properties, in addition to the fact that it has the advantage of flexibility, simplicity, and clarity, when compared to other multidimensional poverty methodologies (Silber, 2011;

[4] See, for instance, Alkire and Foster (2011a); Alkire, Foster, Seth, Santos, Roche, & Ballón (2015); Atkinson (2003); Bourguignon and Chakravarty (2003); Brandolini and Aaberge (2014); Chakravarty (2018); Chakravarty, Deutsch, and Silber (2008); Deutsch and Silber (2005); Duclos, Sahn, and Younger (2008); Kakwani and Silber (2008b); Klasen (2000); Lemmi and Betti (2006, 2013); Rippin (2013, 2016, 2017); Tsui (2002).

[5] See [online] https://ophi.org.uk/. A summary of studies that have applied the AF method can be found in Alkire et al. (2015, p. 178-181).

[6] For example: Chile, Colombia, Costa Rica, Ecuador, El Salvador, Honduras, México, and Panamá.

Thorbecke, 2011). However, as discussed by Duclos and Tiberti (2016), it does suffer from several unattractive methodological features that have not yet been sufficiently observed in the literature, which may lead to biased estimates and wrong assessments of overall multidimensional poverty in the society. Of particular concern for this dissertation is the fact that when only ordinal (or dichotomized) variables are available, the commonest case in practice, the measures derived from the application of this methodology pay no attention to the distribution of deprivations, and the resulting indices are thus totally insensitive to inequality among the multi-dimensionally poor individuals (Datt, 2018; Rippin, 2013, 2017). This is a serious defect of any poverty measure, according to Sen's (1976, 1979, 1992) influential arguments that overall poverty indices should be sensitive to inequality, which may lead to leaving behind the poorest of the poor,[7] challenging the central overarching concern of the SDGs agenda: Leaving no one behind (Klasen & Fleurbaey, 2018).[8]

As far as the empirical work is concerned, it is observed in the literature that the vast majority of studies ("the mainstream practice") concerned with the measurement of multidimensional poverty use the household rather than the individual as the unit of analysis, which means that they identify the multidimensional poverty condition of the household with the multidimensional poverty condition of all individuals belonging to the household, ignoring, thus, intra-household inequalities and producing indexes that are insensitive to gender.

But, as observed by Deaton (1997, p. 223), poverty is a feature of individuals, not households, and "if one is serious about what should be the ultimate object of welfare analysis–that is, the welfare of individuals–then limiting the theoretical and empirical analysis at the level of the household is simply unacceptable" (Chiappori, 2016, p. 840). Household-based measures may provide biased estimates of the extent of multidimensional poverty in aggregate: For example, if females are systematically poorer than males, or if children and elderly are systematically worse-off than other household members, overall poverty may be understated when one employs a measure that treats everybody in the household equally (Deaton, 1997); furthermore, when these measures are used, valuable information about the composition of the multi-dimensionally poor may be overlooked

[7] An inequality insensitive poverty measure "can deflect anti-poverty policy by ignoring the greater misery of the poorer among the poor" (Sen, 1992, p. 105).

[8] Note also that Goal 10 of the SDGs calls for reducing "inequality within and among countries" (UN, 2015, p. 21).

(Jenkins, 1991), which may thus affect the targeting and effectiveness of poverty alleviation policies (see, for example, Brown, Ravallion, & van de Walle, 2018). Hence, household-based multidimensional poverty measures are "unreliable at best, and deeply flawed at worst" (Chiappori & Meghir, 2015, p. 1371), and these are not suitable to monitor progress in achieving target 1.2 of the SDGs: "By 2030, reduce at least by half the proportion of men, women and children of all ages living in poverty in all its dimensions according to national definitions" (UN, 2015, p. 15); poverty analysis should therefore be moved from the household to the individual (Espinoza-Delgado & Klasen, 2018; Vijaya et al., 2014).

Consequently, considering the gaps observed in the literature and the current sustainable development agenda, this dissertation contributes to the open issues in the literature on multidimensional poverty analysis and challenges the current practice of multidimensional poverty measurement in developing countries. It aims, overall, to investigate cutting-edge issues in poverty measurement and to provide new insights into the analysis of multidimensional poverty, with empirical evidence from Nicaragua and from other Central American countries, where the poorest people in Latin America and the Caribbean live (Duryea & Robles, 2007; Santos & Villatoro, 2018). Since most existing multidimensional poverty measures in developing countries use the household as the unit of analysis, it proposes to move from the household to the individual in order to capture some of the intra-household inequalities and also produce gender-sensitive multidimensional poverty measures. The dissertation is a collection of independent essays; it comprises four essays, which are briefly summarized below.

Essay 1 (Section 2 of this dissertation), which is based on joint work with Julio López-Laborda, is concerned with estimating multidimensional poverty in Nicaragua and with assessing the trend of the incidence, the intensity, and the severity of multidimensional poverty in this Central American country between 2001 and 2009.[9] It uses a household-based index in order to be able to make comparisons between our estimates of multidimensional poverty (a multidimensional poverty approach) and the official figures of poverty in Nicaragua (a monetary approach), another specific goal of **Essay 1**. Considering that Nicaragua, which is the poorest country in Latin America and the Caribbean (Duryea & Robles, 2007; Santos & Villatoro, 2018), follows a monetary approach to produce its official poverty measure, **Essay 1** emphasizes the necessity of adopting a broader poverty

[9] Data for 2009 were the most recent dataset available when this essay was written.

measurement approach in this country and offers substantial empirical evidence that would support this decision.

Concerning the methodological strategy, in **Essay 1**, we derive a household-based multidimensional poverty measure for Nicaragua that comprises ten dimensions, which account for important aspects of the well-being of Nicaraguan population and are related to basic capabilities (Sen, 2000a). Under each of these dimensions, the registered achievements are scored on a scale of 1 to 5, following the work by Klasen (2000) for South Africa, and the differences are interpreted on a cardinal basis. In general, we follow the Alkire and Foster's methodology but do not set an "arbitrary" multidimensional poverty line (second cutoff) that is required to obtain a specific estimate of multidimensional poverty; instead, we borrow some ideas from the dominance approach (Duclos, Sahn, & Younger, 2008) and use a wide range of thresholds. Nonetheless, for comparison purposes, we estimate an overall measure of multidimensional poverty that follows the structure of the "fuzzy" poverty index proposed by Cerioli and Zani (1990, p. 282), which may be employed to approximate the second threshold demanded by the identification method proposed by Alkire and Foster (2011a). In our analysis, we consider three weighting structures: equal-weightings and two other systems based on the data themselves, one based on the first principal component scores, and the other based on the relative frequencies of dimensional deprivations. Overall, we found that the incidence, the intensity and the severity of multidimensional poverty in Nicaragua decreased between 2001 and 2009, particularly so between 2001 and 2005. We also found that both the monetary and the multidimensional approach show that the proportion of poor people in Nicaragua declined between 2001 and 2009; however, a separate analysis of each of the sub-periods revealed great disparity between one approach and the other.

Since poverty is a characteristic of individuals, not households, and using the household as the unit of analysis overlooks important within-household features and ignores the inequalities that are generated within the households, **Essay 2** (Section 3 of this dissertation), which is based on joint work with Stephan Klasen, aims to take a step forward in the measurement of multidimensional poverty, open the "black box" that is the household (Jenkins, 1991, p. 457), and propose an individual-based multidimensional poverty framework to overcome some of the shortcomings of the existing household-based multidimensional poverty measures. Employing data from Nicaragua (year 2014), we use the proposed framework to estimate individual-based multidimensional poverty and inequality,

as well as the corresponding gender gaps in this country. We apply the methodology proposed by Alkire and Foster (2011a) and the Correlation-Sensitive Poverty Index (CSPI) proposed by Rippin (2013, 2016, 2017), which is an inequality-sensitive multidimensional poverty index, as well as the absolute inequality measure proposed by Alkire and Seth (2014a). We also explore the determinants of multidimensional poverty in Nicaragua by estimating logit regression models.

It is worthy of note that Nicaragua is an interesting study case because it is, as mentioned, the multi-dimensionally poorest country in Latin America and the Caribbean (Duryea & Robles, 2017; Santos & Villatoro, 2018) and, at the same time, according to the Global Gender Gap Index 2017, it is the best-performing country in that region for the sixth year running (World Economic Forum, 2017). To the best of our knowledge, **Essay 2** constitutes the first effort in Latin America and the Caribbean region to estimate gender differences in multidimensional poverty and inequality for the whole population of a country, the first one that applies the CSPI there, and one of the first attempts in the global literature on multidimensional poverty analysis.

In **Essay 2**, overall, we provide strong evidence in support of a more disaggregated multidimensional poverty analysis, since the results show that the multidimensional poverty incidence and inequality can be very different for different age groups in the society. Particularly, we found that in Nicaragua, the multidimensional poverty incidence, estimated to be about 57%, still remains a huge problem, and the monetary approach seems to be incapable of revealing the extent of it. Likewise, the multidimensional poverty intensity is a large concern in this country as well: the multi-dimensionally poor people suffer, on average, from deprivation in more than 50% of the indicators considered in the analysis.

Yet, in **Essay 2**, we found that when a three-dimensional (education, health, and living standard) index is used, multidimensional poverty in Nicaragua does not seem to be feminized: overall, males and females are almost equally likely to be multi-dimensionally poor. The gender gaps are estimated to be lower than 5%; women are slightly better off than men in terms of the poverty incidence (4%) and the MPI index (2%), while the reverse is true for the intensity (2%). However, inequality among the multi-dimensionally poor, an issue that has also been neglected by most of the existing empirical works, is clearly feminized, especially among adults. In Nicaragua, the gender gap in inequality is 12%, and it is in favor of men; this means that the multi-dimensionally poor women are living in very intense

poverty when compared to the multi-dimensionally poor men, even though the observed poverty levels among women and among men are quite similar. Also, as suspected by Bradshaw, Chant, & Linneker (2017a), we found that adding a dimension under which women face larger deprivation into the three-dimensional measure leads to greater estimates of the incidence, intensity, and inequality of women's multidimensional poverty. This finding suggests that evaluations of women's relative multidimensional poverty may depend on what is measured and what dimensions of gendered poverty are included in the assessments (Bradshaw et al., 2017a, 2018).

Essay 3 (Section 4 of this dissertation), which is based on joint work with Jacques Silber, also proposes to depart somewhat from the "mainstream approach", as well as the "mainstream practice", to the measurement of multidimensional poverty and to take an individual-based and inequality sensitive view of multidimensional poverty when only ordinal (dichotomized) variables are available (the commonest case in practice). Based on the general framework proposed by Silber and Yalonetzky (2014) and on Rippin's methodology (2013, 2017), in **Essay 3**, we suggest the adoption of a "fuzzy" identification function that specifies explicitly the kind of relationship existing between the ordinal variables considered in the analysis, eliminating thus some ambiguities of the Alkire and Foster's approach, and a class of multidimensional poverty measures that has the advantage of taking into account efficiency and distributive justice considerations, as stressed by Rippin (2013, 2017), and can also be decomposed into the three I's of poverty, incidence, intensity, and inequality (Jenkins & Lambert, 1997).

We implement the framework suggested in **Essay 3** by looking at poverty data (individuals aged 18 and 59 years) in five Central American countries, namely Guatemala, El Salvador, Honduras, Nicaragua, and Costa Rica. This approach also allows us shedding some light on gender differences in multidimensional poverty and inequality in Central American region, testing whether there are discrepancies between these countries regarding the impact of gender on multidimensional poverty and exploring the determinants of multidimensional poverty in this region on the basis of logit regression models. As far as we know, there is no study of individual-based multidimensional poverty in the specialized literature, similar to this.

Overall, in **Essay 3**, we found that individuals living in Guatemala have the highest probability of being multi-dimensionally poor, followed by the ones from Nicaragua; people

living in Costa Rica, by contrast, have by far the lowest probability of being poor. In the middle appear Honduras and El Salvador, Hondurans having a larger probability of being multi-dimensionally poor than the Salvadorians. Regarding the gender gaps, we found that there are statistically significant gender gaps in multidimensional poverty among adults in Guatemala, El Salvador, Honduras, Nicaragua, and Costa Rica; but the size and direction of these gaps depend on the information incorporated into the analysis. For the incidence of multidimensional poverty, the gender gap is in most cases lower than 5%. In Guatemala, El Salvador and Costa Rica the female poverty incidence rate is higher than that of the males, while no significant gender gap in poverty incidence exists for Honduras and Nicaragua. The female multidimensional poverty intensity seems also to be higher in Guatemala, El Salvador, and Costa Rica, while the results for Nicaragua and Honduras are ambiguous. Inequality among the multi-dimensionally poor women is clearly higher in Nicaragua (above 8%) and Costa Rica (above 7%), suggesting that in these countries, the multi-dimensionally poor women are living in very intense poverty when compared to the multi-dimensionally poor men. The opposite is true for Guatemala and El Salvador. In Honduras, there does not appear to be gender related differences in inequality among the multi-dimensionally poor adults.

In short, in **Essay 3**, we found that in Central America the incidence and intensity of multidimensional poverty are higher among females, while the inequality of poverty is somewhat higher among males. Likewise, the logit regression models revealed that in Central America, there are country- as well as individual-specific gender differences in multidimensional poverty. It also appears that the total impact of gender is statistically significant, but, *ceteris paribus*, it depends also on the marital status of the individuals and the country in which they live.

Essay 4 complements empirically **Essay 3** and attempts to emphasize the necessity of departing somewhat from the mainstream approach to the measurement of multidimensional poverty in developing countries, considering, particularly, the central overarching concern of the 2030 Sustainable Development Agenda, leaving no one behind, and Targets 1.2 and 10.1 of the SDGs. It aims to point out, again, that the current practice of multidimensional poverty measurement is deficient to properly monitor progress in multidimensional poverty reduction mainly because it uses the household as the unit of analysis, ignoring thus intra-household inequalities, and is totally insensitive to inequality among the multi-dimensionally poor individuals.

Based on **Essay 3**, we propose in **Essay 4** to adopt a person-focused and inequality-sensitive approach to monitoring progress in multidimensional poverty reduction in developing countries in the context of Goal 1 of the SDGs and in line with the central overarching concern of the SDGs agenda (Klasen & Fleurbaey, 2018). We apply this approach to assess the progress in individual-based multidimensional poverty reduction in Nicaragua between 2001 and 2014. To the best of our knowledge, this is the first attempt in the literature on multidimensional poverty analysis that evaluates progress in multidimensional poverty reduction across the whole population by using a person-focused and inequality-sensitive framework.

Overall, **Essay 4** reveals interesting findings that reinforce the argument that an inequality-sensitive measure would be required to properly monitor progress in multidimensional poverty reduction, as inequality might be a non-neutral (and non-minor) issue over time, particularly in regions such as Latin American and the Caribbean (see, e.g., ECLAC, 2018a); in other words, **Essay 4** shows that inequality among the multi-dimensionally poor individuals does matter and should be incorporated into the multidimensional poverty analysis. We found that in Nicaragua, multidimensional poverty decreased by at least 17% between 2001 and 2014, but this observed progress was not evenly achieved: the reduction in relative terms of the multidimensional poverty for the bottom 20 percent seems not to be substantial compared to the overall estimated decline. As far as inequality among the multi-dimensionally poor is concerned, we found that it increased by at least 24% during the period of analysis; that is, people's deprivation scores were less unequally distributed in 2001 than in 2014, which suggests that progress in multidimensional poverty reduction in Nicaragua seems to be leaving behind the poorest of the poor, challenging thus the overarching concern of the SDGs agenda.

2. Trend of multidimensional poverty in Nicaragua between 2001 and 2009[10]

Abstract

In this essay, we estimate multidimensional poverty in Nicaragua between 2001 and 2009, mainly following the methodology proposed by Alkire and Foster (2007, 2011a). We use ten dimensions and propose three weighting structures: equal-weightings and two other systems based on the data themselves, one based on the first principal component scores, and the other based on the relative frequencies of dimensional deprivations. Overall, the results show that the incidence, intensity, and severity of multidimensional poverty in Nicaragua declined between 2001 and 2009, and particularly so between 2001 and 2005.

[10] The chapter is based on joint work with Julio López-Laborda. A similar version of this essay is published in *CEPAL Review* [https://www.cepal.org/en/publications/42008-nicaragua-trend-multidimensional-poverty-2001-2009]; it has also been published in Spanish in this journal [https://repositorio.cepal.org/bitstream/handle/11362/41143/1/REV121_EspinozaLopez.pdf]. A preliminary draft of this essay was discussed at the 2015 OPHI Summer School on Multi-dimensional Poverty Analysis, which was held at Georgetown University, in Washington D.C., USA, on August 1st – 15th. We would like to thank participants at this academic event for helpful general discussions on multidimensional poverty analysis, especially to Sabina Alkire, James Foster, Martin Ravallion, Suman Seth, and Bouba Housseini. We would also like to thank Stephan Klasen, Jacques Silber, and two anonymous referees for useful comments. José Espinoza-Delgado would like to acknowledge financial support by the University of Zaragoza and the German Academic Exchange Service.

2.1. Introduction

The conceptual understanding of poverty has been improved and deepened notably in the last three decades or so, mainly thanks to the seminal work of Amartya Sen and his theoretical framework of "capabilities and functionings",[11] considered as "the most comprehensive and therefore logical starting point in an attempt to capture the concept of poverty" (Thorbecke, 2008, p. 4). There is currently a broad consensus that poverty is a multidimensional phenomenon and that its analysis cannot be confined to the study of a monetary dimension (Atkinson, 2003; Kakwani & Silber, 2008; Stiglitz, Sen, & Fitoussi, 2009a, 2009b) —whether per capita income or per capita consumption expenditure— as suggested by the monetary (income) approach to the measurement of poverty. In this context, a broader poverty measure, which considers other attributes apart from income (Atkinson, 2003), is a key and necessary input for the design, monitoring, and evaluation of poverty-reduction policies.

Taking Sen's ideas as a conceptual framework, and returning to previous work by Espinoza-Delgado and López-Laborda (2015), in this essay, we estimate poverty in Nicaragua from a multidimensional standpoint, using data from the last three available editions of the National Households Survey on Living Standards Measurement (EMNV, 2001, 2005, and 2009)[12] and applying the class of multidimensional poverty measures (M_α) proposed by Alkire and Foster (2007, 2011a). Specifically, we compute "the adjusted headcount ratio (M_0)", "the adjusted poverty gap (M_1)", and "the adjusted FGT measure (M_2)", as well as "the headcount ratio (H)" and the "average deprivation share (A) across the poor" (Alkire & Foster, 2011, p. 479); we also compare the trend of multidimensional poverty with the headcount ratio estimated by applying the official methodology used to measure poverty in Nicaragua, which basically follows a monetary approach.[13] Before estimating the referred measures, we compute an overall measure that follows some of the ideas of the fuzzy poverty measurement proposed by Cerioli and Zani (1990), which is also compared against the official poverty estimates; such a measure could also be used as an anchor to approximate the second cutoff (or "intermediate cutoff level") required by the Alkire and Foster methodology to identify individuals who are multi-dimensionally poor and

[11] See, for instance, Sen, 1984, 1985, 1992, 1993, 2000a, 2008.

[12] The 2001-EMNV, 2005-EMNV, and 2009-EMNV were the most recent surveys available when this essay was written.

[13] See, for instance, INEC-NI, 2002a, 2002b, 2003; INIDE, 2007, 2010, 2011a, 2011b.

to obtain a specific estimation based on this methodology (Alkire and Foster 2011a, p. 478), which is not done in this essay. Our analysis considers ten "dimensions" that are then aggregated by using three alternative weighting structures. Apart from equal weights, we propose two weighting systems obtained from the data themselves: one based on the first principal component scores, and the other one based on the relative frequencies of deprivations in the different dimensions.

In the literature, there are few studies on poverty in Nicaragua, and even fewer empirical works have analyzed poverty from a multidimensional perspective that go beyond the Unsatisfied Basic Needs (UBN), which has been widely applied in Latin America and the Caribbean (Battiston, Cruces, López-Calva, Lugo, & Santos, 2013; Boltvinik, 2013; ECLAC, 2009; Santos, Lugo, López-Calva, Cruces, & Battistón, 2015). Note that this situation is not peculiar to Nicaragua; there are few studies on multidimensional poverty in all of Latin American countries (Battiston et al., 2013; Roche & Santos, 2012), and the monetary approach (income poverty) has dominated the studies undertaken, particularly in Central America (ECLAC, 2009).[14]

One of the earliest attempts —if not the first— to measure multidimensional poverty in Nicaragua (and also in other Central American countries) can be found in the 2003 ECLAC study of poverty and social vulnerability; such a study applied the Integrated Poverty Measurement method proposed by Katzman (1989), which considers jointly the income incidence and unsatisfied basic needs (ECLAC, 2003). Although this paper was innovative at the time, its suggested approach has several methodological weaknesses; for instance, it gives a major role to income (ECLAC, 2009), and it does not take account of the dimensional deficits, an issue raised by Bourguignon and Chakravarty (2003). Another ECLAC study used a variety of methodologies (ECLAC, 2009), apart from the Kaztman measure —the Alkire and Foster methodology, principal components and cluster analysis— to estimate multidimensional poverty in Mexico and Central America (including Nicaragua). Like Katzman's paper (Katzman, 1989), this ECLAC study made a joint analysis of per capita income and seven dimensions of UBN (housing, overcrowding, water, sanitation, education, electricity, and household consumption capacity). It applied the Alkire and Foster

[14] ECLAC (2009) summarizes the different studies that have used different methodologies to measure multidimensional poverty in Latin America, and particularly in Central America. For the specific case of Nicaragua, there are only two references: Del Carpio and Castro (2007), which uses a subjective approximation of well-being, and ECLAC (2003), which uses the "integrated poverty measure" proposed by Kaztman (1989).

methodology to the case of Nicaragua for the first time and estimated H and M_0 using data from the 2005-EMNV. The study found that 84.3% of the Nicaraguan population was deprived in at least one dimension in 2005, while 0.1% faced deprivations in all of the considered dimensions; it also found that M_0 ranged from 30.7% to 0.1% (ECLAC, 2009, p. 38).

The ECLAC work of 2009 was followed by the paper of Alkire and Santos (2010, 2014), who proposed the global multidimensional poverty index (global-MPI) and included estimations of multidimensional poverty in Nicaragua. Such an index adheres to the mathematical structure of one of the measures of the Alkire and Foster methodology (M_0) and considers 10 indicators representing the three dimensions that are used to calculate the Human Development Index (HDI) published by the United Nations Development Program (UNDP). Using data from the 2001 Nicaraguan Demography and Health Survey (DHS), Alkire and Santos (2010) found that 40.7% of the Nicaraguan population was living in conditions of multidimensional poverty; they also estimated an M_0 of 0.211 for Nicaragua so that this country was ranked 64th out of a total of 104 developing countries, with an M_0 of 0.211 (Alkire & Santos, 2010, p. 75). It is worth noting that the index proposed by Alkire and Santos (2010) has been adopted by UNDP and has formed part of the Human Development Report since 2010 (UNDP, 2010). Nonetheless, as it is an acute poverty index, it gives relatively lower estimations for Nicaragua, and even for all of Latin America; so its results are not very relevant to the reality of the country and region as a whole (Roche & Santos, 2012). Then, the National Human Development Report for 2011, prepared by the UNDP Office in Nicaragua (UNDP, 2011), suggested the Youth Multidimensional Poverty Index (IPMJ) for the Nicaraguan population aged between 13 and 29 years, which incorporates four dimensions (education, employment, health, and household conditions) and uses the M_0 measure of the Alkire and Foster methodology. Using data from the 2001 and 2005 EMNV and the 2009 Household Survey for poverty measurement of the International Foundation for the Global Economic Challenge (FIDEG),[15] the report concluded, among other things, that in Nicaragua, the proportion of young people and adolescents who were multi-dimensionally poor declined by 8.3 percentage points between 2001 and 2009 (UNDP, 2011, p. 82). Lastly, Roche and Santos (2012) analyzed the results of the MPI for 18 Latin American and the Caribbean countries, including Nicaragua, and proposed a number of amendments to the

[15] See [online] www.fideg.org.

index to better reflect multidimensional poverty in the region and to make the estimations more relevant.

Thus, to the best of our knowledge, this essay, together with the earlier work by Espinoza-Delgado and López-Laborda (2015), represents the first attempt to measure and determine the trend of multidimensional poverty in Nicaragua, at the national level and for the population as a whole, using data from the last three available EMNVs, which the Government of Nicaragua uses to measure poverty (INEC-NI, 2002a, 2002b, 2003; INIDE, 2007, 2011a). These surveys also have the advantage of including information on the income and expenditure of Nicaraguan households, which makes it possible, among other things, to compare the trend of monetary and multidimensional poverty. This essay is also the first attempt to measure the intensity and severity of multidimensional poverty in Nicaragua — two aspects of poverty that are not estimated in the literature that deals with the measurement of multidimensional poverty in Nicaragua and elsewhere, perhaps owing to the nature of the data. Naturally, the intention is not to propose "an ideal multidimensional poverty measure", but to provide empirical evidence for adopting a broader approach to measuring poverty in the country, which complements the official estimations and helps to reduce the deficit in the specialized literature on Nicaragua and the region. The essay is organized as follows: section 2.2 describes the data and methodological issues (multidimensional poverty measures, the choice and justification of the dimensions and indicators, dimensional poverty lines and weightings); section 2.3 presents the main results obtained; section 2.4 addresses issues relating to the bilateral correlations and overlaps in identifying the poor; while section 2.5 sets out a number of conclusions.

2.2. Data and methodological issues

The data analyzed are drawn from the last three implementations of the Household National Survey on Living Standard Measurement (EMNV for its name in Spanish), available when this essay was written (EMNV-2001, EMNV-2005, and EMNV-2009), conducted by the National Information and Development Institute (INIDE) of Nicaragua, with support from the World Bank.[16] The sample encompassed 4,191 households (22,810 people) in 2001; 6,882 households (36,612 people) in 2005; and 6,515 households (30,432 people) in 2009. Given the aim of this essay, the household is the unit of analysis chosen to

[16] Previously, INIDE was the National Institute of Statistics and Censuses (INEC-NI).

identify the poor.[17] Nonetheless, information pertaining to individuals is also incorporated, and related to the household in question; and the results are presented in population terms using the survey expansion factors.

2.2.1. Multidimensional poverty measures

According to Sen (1976, p. 219), two problems need to be addressed when measuring poverty: the identification of the poor in the wider population, and the construction of a poverty index that uses the available information on the poor. To resolve these two issues, in a multidimensional context for Nicaragua, this essay follows the Alkire and Foster (2007, 2011a) methodology, which consists of an identification method (ρ_k), which expands the traditional approaches of union and intersection, and a family of measures (M_α), which resolves the second issue.[18] The identification method uses two cut-offs: one within each dimension (dimensional cut-off) to determine whether the unit of analysis is deprived in that specific dimension; and a second cut-off between the dimensions (k), which identifies the multi-dimensionally poor by counting the dimensions in which the unit of analysis is deprived. Alkire and Foster (2011a, p. 478) suggest setting the value of k at some intermediate point between the two extremes that represent the traditional approaches (see Atkinson, 2003), which is controversial and arbitrary; this essay follows, therefore, the principles of the dominance approach for analyzing poverty and uses a wide range of k-values (Duclos, Sahn, & Younger, 2008, p. 246). The M_α measures, meanwhile, are based on the Foster-Greer-Thorbecke (FGT) family of measures, suitably adjusted to take account of multidimensionality. In this essay, apart from the multidimensional headcount ratio (H), we calculate "the adjusted headcount ratio (M_0)", "the adjusted poverty gap (M_1)", and "the adjusted FGT measure (M_2)" (Alkire & Foster, 2011, p. 479).[19] Accordingly, we address the

[17] This is a normative decision making it possible to appropriately compare the estimations made in this study with the official figures and with estimations of the multidimensional poverty index for Nicaragua. In addition, the household represents the unit observation used by the surveys used (INEC-NI, 2006, p. 4; INIDE, 2011b, p. 4).

[18] The union approach classifies a household as poor if it suffers deprivation in at least one dimension. At the other extreme, the intersection approach requires the household to suffer deprivation in all dimensions, to be considered poor (Atkinson, 2003).

[19] H measures the fraction of the population that is multi-dimensionally poor; M_0, which "is sensitive to the frequency and the breadth of multidimensional poverty", is obtained by multiplying H by "the average deprivation share" across the multi-dimensionally poor (A); M_1 is the product of M_0 and the "average poverty gap (G)"; M_2 is the product of M_0 and the "average severity index (S)", and it is sensitive to the inequality of the distribution deprivations among the poor (Alkire & Foster, 2011, p. 479).

three "dimensions" of poverty —incidence, intensity, and inequality— which have been called the "three I's" of poverty (Jenkins & Lambert, 1997, p. 317).

Before calculating the measures referred to above, we estimate a measure that follows the structure of the "fuzzy" poverty index proposed by Cerioli and Zani (1990), which could also be used to approximate the second cut-off required by the identification method of Alkire and Foster (2011a). This measure is defined as (Cerioli & Zani, 1990, p. 282):

$$P = \frac{1}{n}\sum_{i=1}^{n} \mu_A(i) \qquad (2.a)^{20}$$

where $\mu_A(i)$ denotes, for each household, a degree of belonging to the subset of the multi-dimensionally poor, and it is constructed according to the following expression:

$$\mu_A(i) = \frac{\sum_{j=1}^{d} w_j Pr_{ij}}{\sum_{j=1}^{d} w_j} \quad (i = 1,2,\dots,n) \qquad (2.b)$$

where w_j represents the weighting of dimension j, and Pr_{ij} reflects the deprivation of household i in dimension j. Thus, Pr_{ij} will take the value 1 if the i^{th} household is deprived in dimension j, and 0 otherwise. Therefore, $\mu_A(i) = 0$ if the i^{th} household does not suffer deprivation in any dimension, which would mean that it was clearly not poor; $\mu_A(i) = 1$ if the i^{th} household suffers deprivation in all dimensions, which would make it clearly a multi-dimensionally poor household; and $0 < \mu_A(i) < 1$ if the i^{th} household is deprived in some but not all of the dimensions.

2.2.2. Choice and justification of the dimensions and indicators

The basic premise of any multidimensional approach to the analysis of poverty is that there are relevant dimensions of well-being that income (or consumption) is not able to capture: "The quality of life is something more than simply a given amount of resources" (Chiappero Martinetti, 2000, p. 207). As noted by Alkire and Santos (2010, p. 11), the choice of the relevant dimensions is a value judgment rather than a technical exercise, and it is "a crucial step" in defining a multidimensional poverty measure (Battiston et al., 2013, p. 294).

[20] P represents the "proportion" of individuals that belong, in a "fuzzy sense", to the subset of multi-dimensionally poor; and it can provide "an effective measure of the total extent of poverty in the population" (Cerioli & Zani, 1990, p. 282).

Accordingly, in this essay, our selection of dimensions (and indicators) is based on normative assumptions with reference to the Millennium Development Goals (MDGs) and the Unsatisfied Basic Needs Approach (UBN). We consider a set of dimensions and indicators that certainly reflect important aspects of the well-being of the Nicaraguan population and are directly related to "specific capabilities" (Klasen, 2000, p. 38). Considering the attainments, as described by the selected indicators, as "a matter of degree" rather than an "all or nothing" condition (Chiappero-Martinetti, 2006, p. 100), and taking advantage of the information available on them, in this essay, we have scored each (dimension) indicator on a scale of 1 to 5, following the work by Klasen (2000) for South Africa: "A score of five represents the best possible standard or condition, a score of three should allow a basic level of welfare to lead a simple, but reasonably safe and healthy existence, while a score of one is an indication of severe deprivation, severe health hazards, and few physical and human resources" (p. 39). With this scoring structure, differences in the levels of achievement are interpreted on a cardinal basis: an achievement that obtains a score of 4 is interpreted as being twice as good as one that scores 2. Although this is arguable, in most cases the scoring is quite intuitive, and it is unlikely to cause much debate. Moreover, "the cardinal interpretation of the scores is, in most cases, a fair approximation of the differences in the achievements" (Klasen, 2000, p. 39).[21] Table 2.1 shows the dimensions, indicators, and scores associated with each achievement.

The first dimension is income, measured as per capita consumption expenditure and, using the quintiles as scores.[22] On one hand, as observed by Sen (2000a, p. 87), a lack of income can be a major cause of "a person's capability deprivation"; on the other hand, having a decent income is also related to Goal 1 of the MDGs: "Eradicate extreme poverty and hunger" (UN, 2015a, p. 4). We adopt a relative approach in this dimension, based on the idea that being relatively poor "can prevent an individual from achieving some elementary functionings", such as participating in community life or appearing in public without shame (Sen, 2000a, p. 71).

[21] It is worth mentioning that the used procedure "shares the same problem of the utilitarian approach to measuring poverty which also necessitates a cardinal interpretation of observed ordinal preference relations" (Klasen, 2000, p. 39).

[22] A practical reason for using consumption instead of income is that households might be more willing to reveal, or better able to remember, what they have spent than what they have earned (WBI, 2005, p. 29). In the case of Nicaragua, according to INIDE (2010, p. 5), information on consumption, seen as an indicator of well-being, tends to be more reliable, precise, and of better quality than that on income, because the informer does not relate it to the payment of taxes.

Table 2.1: Dimensions and indicators

Dimension	Description of the indicator used	1	2	3	4	5
Income	Quintiles of per capita consumption expenditure	Poorest quintile	Quintile 2	Quintile 3	Quintile 4	Wealthiest quintile
Years of schooling	Average years of schooling of adult members of the household (16+ years of age)	0 <= 3	> 3 <= 6	> 6 <=10	> 10 <=14	> 14
Children in school	Percentage of children of 6 to 16 years of age attending school	0% - 19%	20% - 39%	40% - 59%	60% - 79%	80% - 100%
Housing	Compound index that simultaneously considers construction materials used in the floor, walls, and roof of the housing	3 <= 6	> 6 <= 9	> 9 <= 12	> 12 <= 14	> 14
Room availability	Proportion of total rooms available per household member	0 – 0.19	0.20 – 0.39	0.40 – 0.59	0.60 – 0.79	0.80 - over 1.00
Water	Water access source	River, ravine, stream, other	Water source or spring, lake, pond, truck, cart or barrel, other house, neighbor or firm	Public standpipe, Public or private pit	Pipe connected to the public grid outside the home, but on the land	Pipe connected to the public grid inside the home
Sanitation	Type of sanitary service	None	Toilet or latrine without treatment, or toilet that discharges into the river or ravine	Toilet or latrine without treatment	Connected toilet or sump or septic pit	Toilet connected to the wastewater pipe
Electricity	Type of lighting in the home	None	Gas or kerosene (candle)	Electricity generator	Other	Electric energy grid
Assets	Number of durable goods that belong to the household (including radio, television, refrigerator, bicycle, vehicle, and others)	0 - 1	2 - 4	5 - 7	8 - 10	Over 11
Energy	Mainly cooking fuel used	Firewood	Coal	Gas, kerosene, or other fuel	Butane or propane gas	Electricity, or do not cook

Note: A score of 1 represents the worst condition or severe deprivation, while a score of 5 indicates the best condition.

The next two dimensions (years of schooling and children in school) reflect a capability which is clearly one of the most important aspects of well-being: education (Stiglitz, Sen, & Fitoussi, 2009a, 2009b). A household's education level, measured as the average number of years of schooling of its adult members (aged 16 years or older), approximates the level of knowledge and understanding of household members, and can be seen as a relatively good proxy variable of "basic educational skills": reading, writing, numeracy, understanding of information, and others (Alkire & Santos, 2014, p. 254). Although it does not reflect the quality of education or the level of knowledge or skills attained, it is a robust and widely used indicator (Alkire & Santos, 2010, 2014). The dimension of children in school records the attendance of children at educational institutions. The indicator used in this essay is the percentage of children aged 6-16 years (both inclusive) who are attending school, in line with the second MDG: "Achieve universal primary education" (UN, 2015a, p. 4).[23] Although, again, school attendance does not reflect the quality of the educational institution or the skills acquired, it is the best possible indicator to indicate whether or not school-age children are being exposed to a learning environment; and it is considered a good enough proxy for educational functionings (Alkire & Santos, 2010, p. 14).

Housing and room availability are the fourth and fifth dimensions, respectively. Housing is a simple compound index, formed by three variables that reflect the type of material that is mainly used in the floor, walls, and roof, and it proxies for the quality of the dwelling in which the household lives.[24] For various intrinsic and instrumental reasons, the quality of housing is a key indicator of well-being. An instrumental reason is that housing quality involves factors that are important for health and safety; intrinsically, it has a direct influence on the well-being of its occupants (Klasen, 2000).[25] The room availability dimension, measured by the proportion of the total number of rooms available per household member (excluding kitchen, bathroom, passageways, and garage) is related to the quality of the home and is also an important dimension of well-being. Overcrowding directly affects

[23] Households with no children between 6 and 16 years of age have been assigned a proportion of 100% and, therefore, a score of 5, because they would not be suffering from deprivation in this dimension.

[24] Each of these three variables was, previously, re-codified to the scoring scale of 1 to 5 and was then added together, with equal weightings, to obtain a joint indicator of the three. Lastly, this joint indicator was re-codified to the scale of 1 to 5 to obtain the dimension (see Table 2.1).

[25] Living in a house with non-precarious wall materials is generally included in the UBN approach (Santos et al., 2015, p. 11).

well-being, since it is a key factor in the transmission of diseases and does not contribute to a healthy environment (Elender, Bentham, & Langford, 1998; Cage & Foster, 2002).

Water and sanitation are the next two dimensions. Both are included in target 7.C of the MDGs ("Halve, by 2015, the proportion of people without sustainable access to safe drinking water and basic sanitation"),[26] and they have "considerable intrinsic and instrumental significance" (Klasen, 2000, p. 41). Drinking (safe) "water is necessary for health and well-being" (Jain, 2012, p. 1); it is also considered as a "human right" (Noga & Wolbring, 2013, p. 1878). Moreover, access to water generates time savings that can be used in other activities (Boone, Glick, & Sahn, 2011). Sanitation is an important component of well-being as well, since adequate sanitation is "fundamental to good health and to social and economic development" and prevents a number of diseases (Mara, Lane, Scott, & Trouba, 2010, p. 1); it is also normally considered in the UBN approach (Battiston et al., 2013).

Electricity is the eighth dimension, for which the indicator used in this essay is the type of lighting in the home. This dimension is directly related to the seventh MDG (Santos & Ura, 2008): "Ensure environmental sustainability" (UN, 2015a, p. 7). As noted by Santos and Ura (2008, p. 8), increasing access to electricity is one of the key aims pursued by this goal, because it will not only improve people's living conditions, particularly among the rural population, but will also lessen the proportion of inhabitants who use solid fuels, thereby improving air quality. Electricity is generally also a safer form of lighting (Alkire & Santos, 2010).

Our measure also includes an asset dimension, which considers the equipment available to the household, in the form of utensils, bicycles, vehicles and other durable goods, given their instrumental importance in facilitating work in the household, improving health, and helping the household to maintain contact with the world outside (Klasen, 2000). The indicator used is the number of consumer goods that belong to the household, prepared from a list of 29 items (radio, television, cooker, refrigerator, washing machine, bicycle, vehicle and others) included in the section on household equipment of the databases used.

The last dimension is energy, which reflects the type of fuel used by the household for cooking. This dimension is also included because of its intrinsic and instrumental importance,

[26] See [online] https://millenniumindicators.un.org/unsd/mi/pdf/mdglist.pdf.

in addition to being related to the MDGs, having clear implications for health and living standards, and particularly affecting women. A clean fuel for cooking prevents respiratory diseases, contributes to a healthy environment in the home and reduces accidents in the home. Its importance is therefore clear (Alkire & Santos, 2010; Klasen, 2000).

2.2.3. Dimensional poverty lines and weightings

All of the dimensional poverty thresholds are set at 3, except for "children in school", which is set at 5, which should be regarded as a normative decision. Therefore, a household that scores under three in a given dimension (or less than five) is considered deprived in that dimension; as are all of its members. The rationale for these poverty lines is the same as used in forming the dimensions, as discussed above: a weighting of 3 implies a minimum acceptable level of well-being. In the children-in-school dimension, a relatively stricter approach is taken, given its nature, requiring at least 80% of children to be attending school. All of the poverty lines coincide with what is generally reported in the empirical literature, although, in those cases, the indicators used have been defined dichotomously.[27]

As noted by Decancq and Lugo (2013, p. 9), weighting the dimensions involves value judgements with clear normative implications. In this essay, we propose three weighting structures. The first, widely used in the literature,[28] assumes that all the dimensions are equally important; so it assigns an equal weight to each of them (1/10). This makes it possible to study the trend of multidimensional poverty in Nicaragua between 2001 and 2009; and it also makes the index easy to interpret (Atkinson, Cantillon, Marlier, & Nolan, 2002).

In addition, two alternative weighting systems are proposed, derived from the data themselves, which makes it possible to illustrate the sensitivity of the measures to variations in the parameters (in this case the weightings) and to some extent test the robustness of the estimations. For the first of these systems, Principal Components Analysis (PCA) is used: a data reduction technique that is widely employed in exercises of this type.[29] The Component Score Coefficient Matrix is used to calculate the weighting structure. Considering the results for the first principal component, these coefficients are normalized to a range of [0, 1], by dividing each of them, firstly, by the corresponding standard deviation of the original

[27] See, for instance, Alkire and Santos (2010, 2014); Santos and Ura (2008); Santos et al. (2015).

[28] See, for example, Alkire ad Santos (2010, 2014); Batana (2013); Battiston et al. (2013); Whelan, Nolan, and Maître (2014).

[29] See, for instance, Cahill and Sánchez (2001); Klasen (2000); Noorbakhsh (1998); Ray and Sinha (2015).

dimension and then, by the overall sum of these divisions. The advantage of this method is that it empirically reveals the commonalities between the individual dimensions and bases their weightings on the strength of the empirical relation between the poverty measure and the individual dimensions. The drawback is that it implicitly assumes that only the components that have a strong correlation are relevant, which could be debatable (Klasen, 2000). Nonetheless, this method is less arbitrary than the first one.

The second alternative weighting system uses the relative frequencies of the deprivations in each dimension. In the context of multidimensional poverty analysis, some researchers assume that there should be an inverse relation between the frequency of deprivation in a given dimension and the weight assigned to that dimension: more frequent deprivations obtain a lower weighting.[30] This reflects the idea that people attach greater importance to the shortfalls in dimensions in which most people are not deprived; a person might feel more deprived if his or her deprivation is shared by a minority group than if most people were similarly deprived (Decancq & Lugo, 2013, p. 19). Following Cerioli and Zani (1990, p. 277), if f_j is the relative frequency of individuals that suffer deprivation in a given dimension, the weights can be derived from the following expression:

$$w_j = \frac{\log\left(\frac{1}{f_j}\right)}{\sum_{j=1}^{d} \log\left(\frac{1}{f_j}\right)} \quad f_j > 0;\ j = 1 \dots d. \qquad (2.c)$$

To the best of our knowledge, the latter two procedures for deriving weighting systems in multidimensional poverty measurement are innovative for the case of Nicaragua. Accordingly, these exercises constitute the first attempt to propose alternative weighting systems rather than weighting all dimensions equally. Table 2.2 shows the weightings in question.

[30] See, for example, Cerioli and Zani (1990); Cheli and Lemmi (1995); Deutsch and Silber (2005).

Table 2.2: Weighting structures (percentages).
Source: Author's estimates based on the National Households Survey on Living Standards Measurement (EMNV) of 2001, 2005, and 2009.

Dimension/Year	Equal weights	Weights based on a principal components analysis			Log(1/fj) weights		
	All	2001	2005	2009	2001	2005	2009
Income	10.0	10.2	9.7	10.1	10.2	9.2	8.9
Years of schooling	10.0	12.2	11.6	11.9	10.4	10.7	11.6
Children in school	10.0	5.3	5.7	6.1	14.1	14.7	14.5
Housing	10.0	11.2	11.0	11.0	6.9	7.2	7.5
Room availability	10.0	8.3	7.6	8.7	5.4	7.7	7.5
Water	10.0	11.0	11.1	10.9	20.1	17.8	16.5
Sanitation	10.0	10.6	9.9	10.6	7.8	8.0	6.6
Electricity	10.0	9.2	8.2	8.9	14.3	13.0	14.7
Assets	10.0	12.3	11.8	12.1	6.4	7.1	7.3
Energy	10.0	9.7	13.3	9.7	4.3	4.5	4.7
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Note: Survey weights used.

2.3. Empirical results

2.3.1. Aggregate deprivations by dimension

Figure 2.1 shows the estimated headcount ratio in each dimension ("the uncensored headcount ratio") ranked from highest to lowest in each year (Alkire et al., 2015, p. 236).[31] It can be seen in the figure that, in all years, energy displays the highest deprivation rate: over 60% of the Nicaraguan population suffers from the effects of using an inappropriate fuel to cook their food. This dimension is followed by room availability, assets, housing, and sanitation (not necessarily in this order), all of which have a deprivation rate of above 40%. Conversely, the dimension with the smallest deprivation is water, since less than 19% of the population does not have access to a safe water source.

It can also be observed from Figure 2.1 that between 2001 and 2009, the percentage of deprived people in Nicaragua declined by at least 5.5 percentage points in all dimensions, except in the case of water and sanitation, where it increased by 2 and 1.2 percentage points, respectively. Overall, these results show that the proportion of the population suffering deprivation in each dimension decreased more between 2001 and 2005 than in 2005-2009, both in absolute and relative terms, except for the years-of-schooling and electricity dimensions. In contrast, it is worthy of note that official reports suggest that the incidence of poverty in Nicaragua increased between 2001 and 2005 (by 2.5 percentage points) and declined in 2005-2009 (by 5.7 points) (see, for instance, INIDE, 2007, 2011a). Consequently,

[31] The headcount ratio measures the incidence of deprivation in each dimension and represents the proportion of the population that is deprived in a given dimension.

these initial results cast doubt on the appropriateness of the official approach used to measure and monitor poverty in Nicaragua, and they confirm that poverty is more than monetary deprivation.

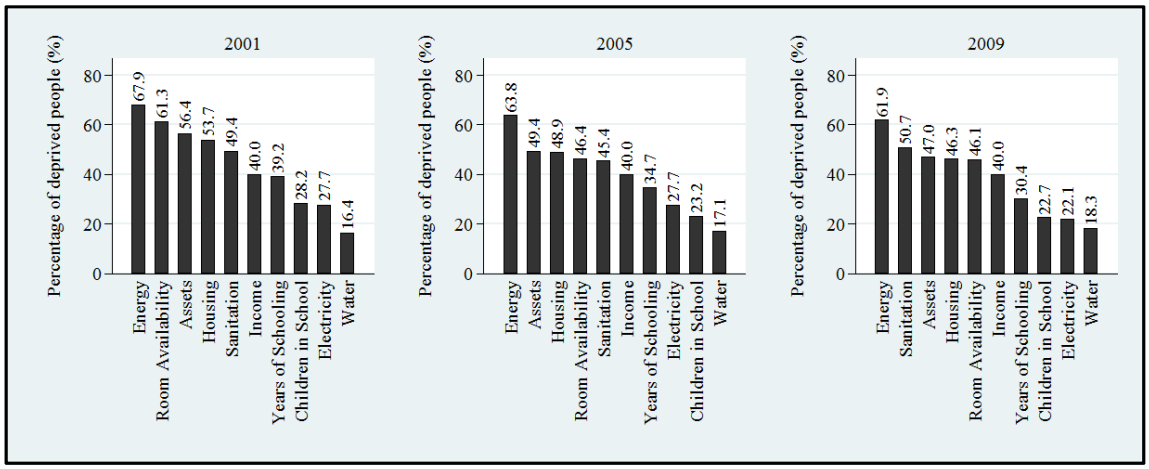

Figure 2.1: Percentage of people deprived in each dimension, ranked from the highest to the lowest.
Source: Authors' estimates based on the National Households Survey on Living Standards Measurement (EMNV) of 2001, 2005 and 2009.
Note: Survey weights used.

2.3.2. Measurement and trend in multidimensional poverty

2.3.2.1. "Proportion" of multi-dimensionally poor people (P)

Table 2.3 reports the "proportion" of multi-dimensionally poor people (P) (Cerioli & Zani, 1990, p. 282), estimated by equation (2.a) of section 2.2.1, for each of the three years of the study, under each weighting system. The results show that multidimensional poverty in Nicaragua declined between 2001 and 2009, irrespective of the weighting system used, owing, above all, to the reduction achieved in 2001-2005.

Table 2.3: Proportion (%) of multi-dimensionally poor, and absolute and relative variation, by weighting system. Confidence intervals at 95%.
Source: Authors' estimates based on the National Households Survey on Living Standards Measurement (EMNV) of 2001, 2005 and 2009.

Panel I: Estimates	Equal weights			Weights based on a principal components analysis			Log (1/fj) weights		
	Lb	P	Ub	Lb	P	Ub	Lb	P	Ub
2001	43.7	44.0	44.4	44.2	44.6	44.9	36.5	36.8	37.1
2005	39.4	39.7	40.0	40.9	40.0	41.5	34.3	34.6	34.9
2009	38.2	38.6	38.9	38.8	39.2	39.6	33.0	33.3	33.7
Panel II: Variations	2005-01	2009-05	2009-01	2005-01	2009-05	2009-01	2005-01	2009-05	2009-01
Absolute	-4.3	-1.1	-5.5	-4.6	-0.8	-5.4	-2.2	-1.3	-3.5
Relative	-9.9	-2.8	-12.4	-10.3	-2.0	-12.1	-6.0	-3.7	-9.5

Notes: Survey weights used; Lb: Lowe bound; P: "proportion" of multi-dimensionally poor; Ub: Upper bound. The confidence intervals at 95% were computed using the bootstrap percentile method with 1,000 stratified bootstrap replications (Efron, 1981, p. 145).

Figure 2.2 compares the trend of the proportion of monetarily poor people, estimated using the official poverty lines (2001: 45.8%; 2005: 48.3%; and 2009: 42.6%),[32] and the trend of the "proportion" of multi-dimensionally poor, under each weighting system. Overall, the two approaches confirm that poverty in Nicaragua declined between 2001 and 2009. Nonetheless, an analysis of each of the periods separately reveals a substantial disparity between one approach and the other. Note that between 2001 and 2005, the official figures show poverty increasing by 2.5 percentage points, whereas our estimates show a reduction of between 5.4 and 3.5 points, depending on the weightings used. Moreover, although the two approaches agree that poverty in Nicaragua declined between 2005 and 2009, the monetary approach shows a much faster reduction in this period than the multidimensional approach, in both absolute and relative terms.

Aside from the theoretical distinctions between the two ways of measuring poverty, it is important to analyze whether the results that these generate, differ, because, if not, the methodological shortcomings of the monetary approach would be less important (Klasen, 2000, p. 36). In this essay, the foregoing results raise an initial empirical doubt as to the suitability of the traditional method of measuring poverty in Nicaragua and underpin the theoretical argument that to measure poverty appropriately, it is necessary to look beyond income.

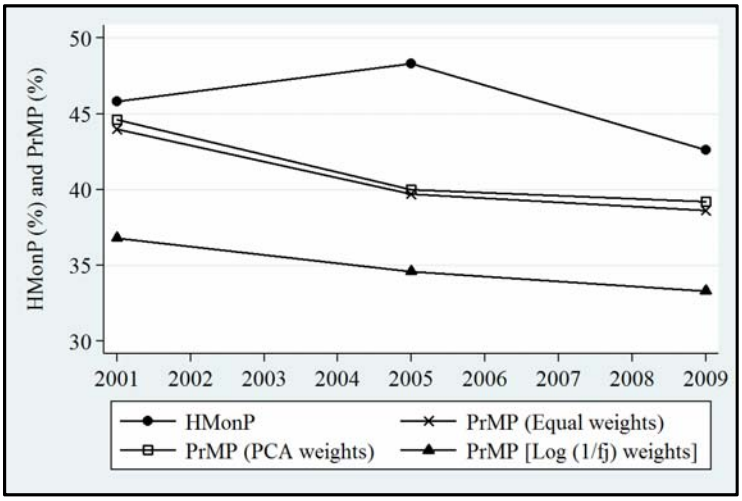

Figure 2.2: Trend of the proportion of monetarily poor (HMonP) and multi-dimensionally poor (PrMP), considering three weighting structures, between 2001 and 2009.
Source: Authors' estimates based on the National Households Survey on Living Standards Measurement (EMNV) of 2001, 2005, and 2009.
Note: Survey weights used.

[32] See INIDE (2007, 2011a).

2.3.2.2. Multi-dimensional headcount ratio (H)

Figure 2.3 shows the estimations of H for different k-values under each weighting system.[33]

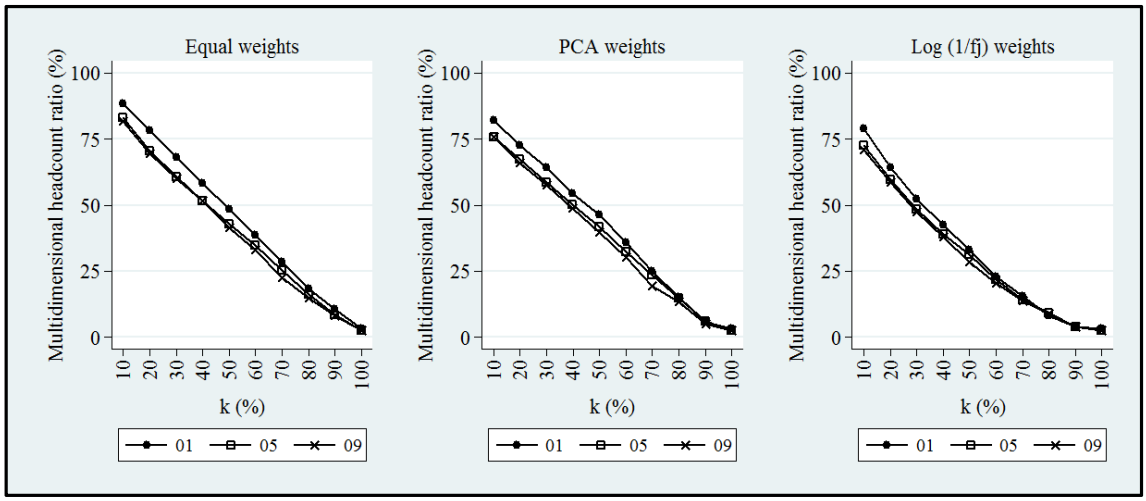

Figure 2.3: Multi-dimensional headcount ratio (H) for different values of k and different weighting structures.
Source: Authors' estimates based on data from the National Households Survey on Living Standards Measurement (EMNV) of 2001, 2005, and 2009.
Note: Survey weights used; 01: year 2001; 05: year 2005; 09: year 2009.

By definition, irrespective of the weightings, the multidimensional poverty incidence declines as k grows. With equal weightings and principal components analysis weightings, and irrespective of the value given to k, the figure clearly suggests that H will always be lower in 2009 than in 2001; accordingly, it can be concluded that the incidence of multidimensional poverty in Nicaragua declined between 2001 and 2009, a finding that is robust to the selection of a multidimensional poverty line. With $\left[\mathrm{Log}\left(1/\mathrm{f_j}\right)\right]$ weightings, the lines intersect when k takes a value of 80%; consequently, in this case, it is not possible to state unambiguously that the incidence of multidimensional poverty is lower in one year than in the other. Nonetheless, for most k-values, the previous conclusion is maintained. This also holds when the two sub-periods are analysed separately. For the first sub-period (2001-2005), only in the case of equal weightings can it be categorically stated that the incidence of poverty declined. In the second sub-period (2005-2009), as the curves intersect, it is

[33] The meaning of the different k-values varies according to the weighting system. With equal weightings, a k of 10%, for example, requires the household to be deprived in any one or more of the 10 dimensions to be considered multi-dimensionally poor. With the other two systems, a k of 10% requires the household to be deprived in at least one dimension or in a combination of them, provided the weight (or the sum of the weights) is at least 10%, to be identified as poor. For example, a household that is deprived only in the room availability dimension would not be considered poor under these two weighting systems (see Table 2.2).

impossible to reach an unequivocal conclusion in either case. Nevertheless, overall, as the intersections occur towards the extremes of the curves, it can be concluded that the incidence of poverty decreased in both sub-periods for plausible values of k.[34]

2.3.2.3. Adjusted multidimensional headcount ratio (M_0) and average deprivation share (A)

Figure 2.4 displays the estimates of "the adjusted multidimensional headcount ratio (M_0)" and "the average deprivation share across the poor" (A) for the three years of the study, with different values of k and with the three types of weighting (Alkire & Foster, 2011, p. 479).

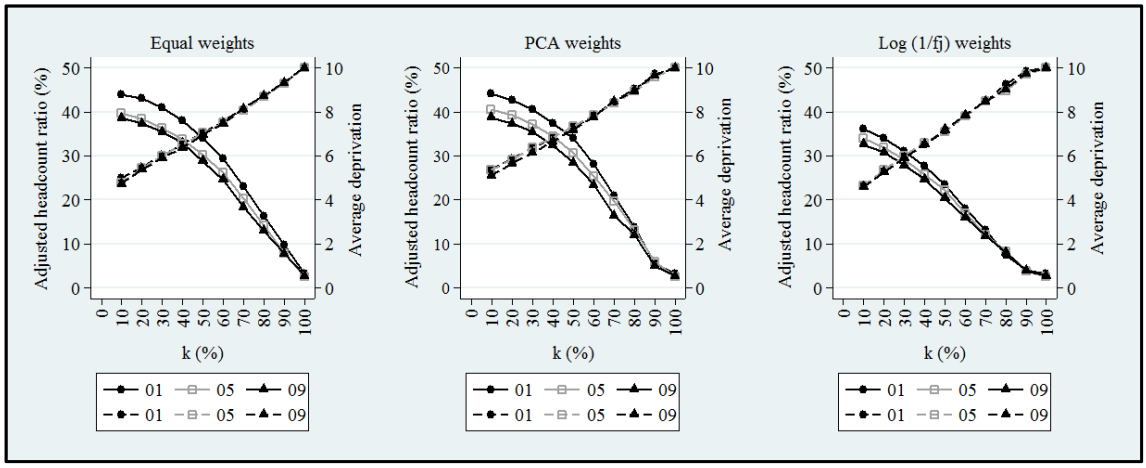

Figure 2.4: Adjusted multidimensional headcount ratio (M_0) and average of deprivations (A).
Source: Authors' estimates based on data from the National Households Survey on Living Standards Measurement (EMNV) of 2001, 2005, and 2009.
Note: Survey weights used; 01: year 2001; 05: year 2005; 09: year 2009.

As can be noted in Figure 2.4, all of the conclusions derived for H are maintained for M_0, which should not be surprising because the calculation of the latter measure takes account of the estimations of the former. Accordingly, observing the criterion of dominance applied above, and assuming plausible k-values, it can be concluded that multidimensional poverty in Nicaragua declined between 2001 and 2009, and more rapidly in 2001-2005. As regards the average deprivation share, which, by definition, increases with k, regardless of the weightings used, in all cases it is high. Even when the union approach is adopted, the multi-dimensionally poor suffer deprivation, on average, in more than four dimensions; and there is no evidence that this has declined significantly during the period of analysis. Consequently,

[34] If the union approach were used, poverty incidence would be exaggerated. At the other extreme, if the intersection approach were used, it would be understated.

the decrease in M_0 is due fundamentally to the reduction in the incidence of poverty and not to the number of deprivations suffered by the poor.

After estimating the adjusted headcount ratio (M_0), the question that naturally arises is how the dimensional deprivations contribute to the estimated multidimensional poverty index. This can be resolved by appropriately decomposing M_0 by dimension, which is one of the attractive properties of this measure (Alkire & Foster, 2011, p. 480). Figure 2.5 shows the breakdown of M_0 by dimension, for different values of k, with equal weightings and for the three years of analysis.

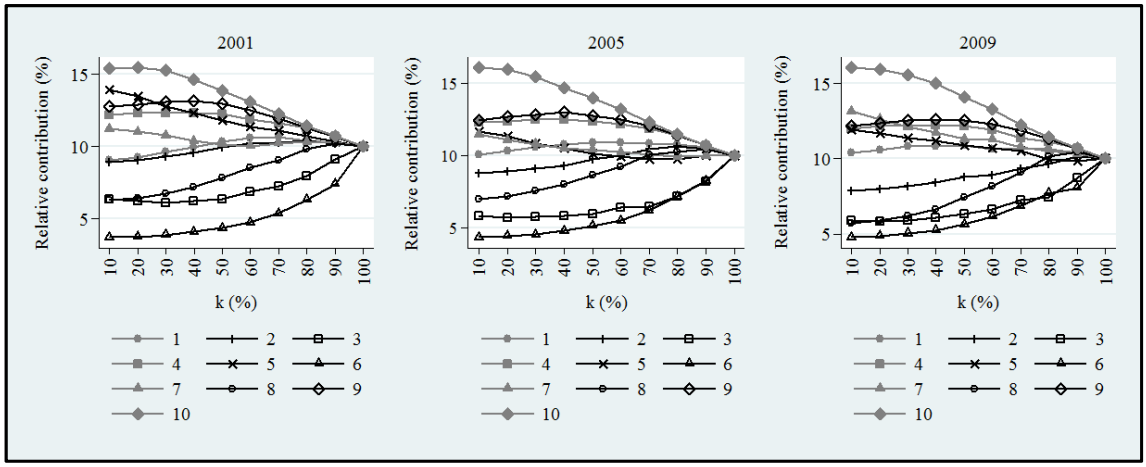

Figure 2.5: Relative contribution of each dimension to the adjusted headcount ratio, for different **k**-values and equal weightings.
Source: Authors' estimates based on data from the National Households Survey on Living Standards Measurement (EMNV) of 2001, 2005, and 2009.
Notes: Survey weights used; 1: Income; 2: Years of schooling; 3: Children in school; 4: Housing; 5: Room availability; 6: Water; 7: Sanitation; 8: Electricity; 9: Assets; 10: Energy.

Figure 2.5 suggests that in Nicaragua, energy is the dimension that contributes the most to multidimensional poverty, for any k and in all years; on average, across all of the k values and years considered, deprivation in this dimension explains roughly 13.3% of overall multidimensional poverty. This dimension is followed by the asset dimension (around 12%) and housing (around 11.7%). It can also be observed from Figure 2.5 that room availability (11.8%), in 2001, and sanitation (10.5%), in 2009, appear among the dimensions contributing most to multidimensional poverty. Note that in all cases, income is not among the three dimensions contributing most to multidimensional poverty; nonetheless, it is fair to say that its contribution is substantial. In contrast, deprivation in water, children-in-school, and electricity contribute the least to multidimensional poverty in Nicaragua. Figure 2.5 also

shows that, with equal weightings, the relative contributions converge, and become equal when k takes the value of 100%.[35]

2.3.2.4. Adjusted poverty gap (M_1) and adjusted FGT measure (M_2)

To complement the foregoing estimates, we also estimated two measures that reflect other important aspects of poverty: the adjusted poverty gap (M_1) that is "sensitive to the depth of deprivation" and the adjusted FGT measure (M_2) that considers "the range and severity of the deprivations" (Alkire & Foster, 2011, p. 479). These both issues clearly act as aggravating factors in multidimensional poverty. Figures 2.6 and 2.7 display the estimates of these two measures for different k-values, with the three weighting systems and for the three years of interest. It can be noted in the figures that, irrespective of the weightings used and where the poverty line is set, both M_1 and M_2 declined between 2001 and 2009; likewise, an analysis of each of the period separately also shows a reduction in both measures between 2001 and 2005 and in 2005-2009.[36]

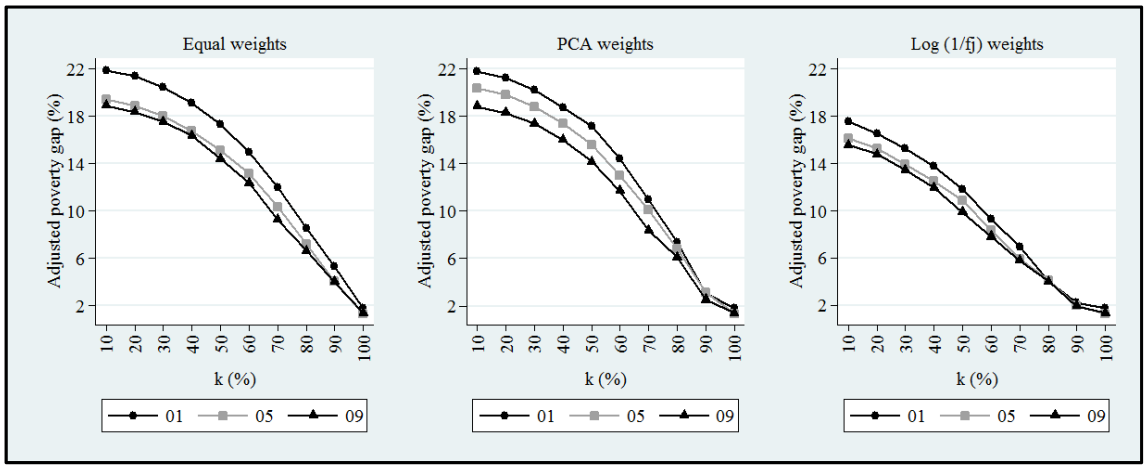

Figure 2.6: Adjusted poverty gap (M_1) for different k-values, with three weighting structures and for 2001, 2005 and 2009.
Source: Authors' estimates based on data from the National Households Survey on Living Standards Measurement (EMNV) of 2001, 2005 and 2009.
Note: Survey weights used; 01: year 2001; 05: year 2005; 09: year 2009.

[35] It is worth mentioning that with principal component analysis weightings, the assets, housing, and energy contribute most to multidimensional poverty, whereas children in school, water, and electricity remain those that contribute the least. In general, with these weightings, the contributions tend to converge as k rises, but they never become equal. As would be expected, the story changes diametrically with Log (1/fj) weightings, given their structure, and the contributions diverge as k rises. In this case, electricity, water, children in school, and years of education are the dimensions contributing most to multidimensional poverty.

[36] Figures 2.A.1 and 2.A.2 in Appendix 2.A show the estimates of "the average poverty gap (G)" and "the average severity index (S)" for the different k-values and with the three weighting systems (Alkire & Foster, 2011, p. 479). It can be clearly seen that G and S declined between 2001 and 2009, irrespective of the weightings adopted and the value defined for k.

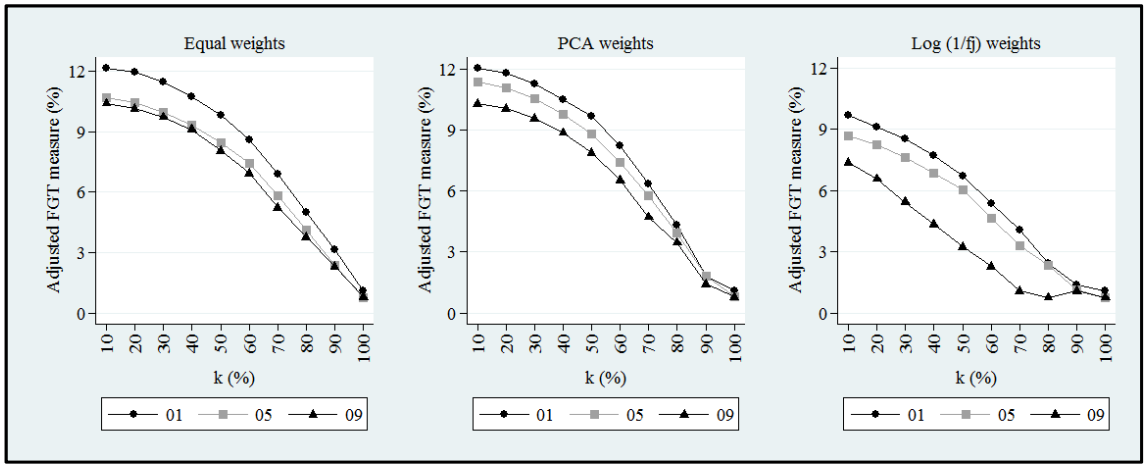

Figure 2.7: Adjusted FGT measure (M_2) for different k-values, with three weighting structures and for 2001, 2005 and 2009.
Source: Authors' estimates based on data from the National Households Survey on Living Standards Measurement (EMNV) of 2001, 2005 and 2009.
Note: Survey weights used; 01: year 2001; 05: year 2005; 09: year 2009.

Consequently, overall, the results of this essay show that the incidence, intensity and severity of multidimensional poverty in Nicaragua declined between 2001 and 2009, and fell faster in the first half of that period (2001- 2005). This conclusion is robust to the choice of a multidimensional poverty line; and, in the vast majority of cases, it also holds with alternative weighting systems.

2.4. Bilateral correlations and overlaps in the identification of the monetarily and multi-dimensionally poor people

Table 2.4 reports the bilateral correlations between per capita consumption expenditure, the official indicator used to estimate extreme and general poverty in Nicaragua, and the aggregate vector of deprivations, obtained from the aggregation of dimensional deprivations, using the three weighting structures; all correlation coefficients are statistically significant at the 1% level.

Focusing on the bilateral correlation coefficients between per capita consumption expenditure and each of the three aggregate vectors of deprivations, it can be seen in Table 2.4 that the two vectors are negatively correlated, which should not be surprising; and they display moderate correlation (lower than 0.58) in all cases.

Table 2.4: Bilateral correlations.
Source: Authors' estimates based on the National Households Survey on Living Standards Measurement (EMNV) of 2001, 2005 and 2009.

GCpc (year)	Aggregate vector of deprivations			Dimensions								
	Equal weights	PCA weights	Log(1/fj) weights	Years of schooling	Children in school	Housing	Room availability	Water	Sanitation	Electricity	Assets	Energy
2001	-0.498***	-0.494***	-0.457***	0.454***	0.173***	0.380***	0.468***	0.345***	0.411***	0.271***	0.487***	0.440***
2005	-0.561***	-0.560***	-0.528***	0.495***	0.200***	0.432***	0.525***	0.393***	0.444***	0.313***	0.545***	0.489***
2009	-0.577***	-0.574***	-0.540***	0.492***	0.227***	0.438***	0.545***	0.354***	0.462***	0.295***	0.533***	0.501***

Notes: The aggregate deprivations vector is obtained by adding the dimensional deprivations, under the three weighting systems. GCpc: Per capita consumption expenditure.
Significance levels: *p < 0.1; **p < 0.05; ***p < 0.01.

As far as the correlation between per capita consumption expenditure and each of the dimensions is concerned, it can be observed from Table 2.4 that it is lower than 0.50, except for room availability and assets in 2005 and 2009; this again suggests a moderate correlation. Accordingly, the argument that income is highly correlated with achievements in other dimensions, so a focus on the monetarily poor will also encompass the deprived in other dimensions (Santos and Ura, 2008, p. 15), seems not to be supported in the case of Nicaragua. The multidimensional approach would thus be justified.

In addition to calculating the correlations, it is also interesting to compare the set of monetarily poor, identified by the official methodology, with the set of multi-dimensionally poor identified using the methodology applied in this essay, to see whether there is any overlap (Alkire & Seth, 2008). Table 2.5 shows the percentage of individuals identified as monetarily poor but multi-dimensionally non-poor, and the percentage of individuals who are multi-dimensionally poor but not monetarily poor. It also shows the monetarily poor and multi-dimensionally poor. The table also reports the under-coverage rate and over-coverage rate of the monetary measure.[37]

The estimates reported in Table 2.5 clearly show that if the official approach to measuring poverty in Nicaragua continues to be used to identify the multi-dimensionally deprived, a non-negligible error would be systematically committed in identifying the poor. If a set of monetarily poor individuals is included but not the multi-dimensionally poor, this would be a type-I error; or if a percentage of the multi-dimensionally poor were excluded because they are not monetarily poor, this would be a type-II error (Santos & Ura, 2008, p. 17). Obviously, minimizing the type-I error, maximizes the type-II error, and vice versa. As table 2.5 displays, both possibilities occur at the extremes of the k-values. Consequently, any intermediate situation involves a combination of both types of error.

[37] The under-coverage rate is the proportion of individuals identified as multi-dimensionally poor but not as monetarily poor, with respect to the total number of multi-dimensionally poor individuals. The over-coverage rate is the proportion of individuals identified as monetarily poor, but not as multi-dimensionally poor, with respect to the total number of individuals identified as monetarily poor (Alkire & Seth, 2008, p. 19).

Table 2.5: Lack of overlap between monetary and multidimensional poverty for different k-values.
Source: Authors' estimates based on the National Households Survey on Living Standards Measurement (EMNV) of 2001, 2005 and 2009.

Year 2001	k-values (%)									
	10.0	20.0	30.0	40.0	50.0	60.0	70.0	80.0	90.0	100.0
Monetarily poor (%)	45.8	45.8	45.8	45.8	45.8	45.8	45.8	45.8	45.8	45.8
Multidimensionally poor (%)	88.3	78.2	67.9	58.1	48.3	38.7	28.4	18.5	10.6	3.2
Both (%)	*45.7*	*45.5*	*44.2*	*41.5*	*38.2*	*33.0*	*25.8*	*17.4*	*10.4*	*3.2*
Monetarily poor but Multidimensionally non-poor (%)	0.1	0.3	1.6	4.3	7.6	12.8	20.0	28.5	35.5	42.6
Monetarily non-poor but multi-dimensionally poor (%)	42.5	32.6	23.7	16.6	10.1	5.7	2.6	1.1	0.2	0.0
Under-coverage rate (%)	*48.2*	*41.7*	*34.9*	*28.5*	*21.0*	*14.7*	*9.2*	*6.1*	*1.9*	*0.0*
Over-coverage rate (%)	*0.2*	*0.6*	*3.5*	*9.3*	*16.6*	*28.0*	*43.6*	*62.1*	*77.4*	*93.0*
Year 2005	k-values (%)									
	10.0	20.0	30.0	40.0	50.0	60.0	70.0	80.0	90.0	100.0
Monetarily poor (%)	48.4	48.4	48.4	48.4	48.4	48.4	48.4	48.4	48.4	48.4
Multidimensionally poor (%)	83.1	70.7	60.7	51.7	43.0	35.0	25.3	16.3	8.5	2.5
Both (%)	*47.9*	*46.3*	*44.0*	*40.7*	*35.8*	*30.5*	*23.2*	*15.6*	*8.4*	*2.5*
Monetarily poor but multi-dimensionally non-poor (%)	0.5	2.1	4.3	7.6	12.6	17.9	25.2	32.7	39.9	45.9
Monetarily non-poor but multi-dimensionally poor (%)	35.3	24.4	16.6	11.0	7.2	4.5	2.1	0.7	0.1	0.0
Under-coverage rate (%)	*42.4*	*34.5*	*27.4*	*21.2*	*16.7*	*12.9*	*8.4*	*4.1*	*1.1*	*0.0*
Over-coverage rate (%)	*1.0*	*4.3*	*8.9*	*15.8*	*26.0*	*37.0*	*52.1*	*67.7*	*82.6*	*94.8*
Year 2009	k-values (%)									
	10.0	20.0	30.0	40.0	50.0	60.0	70.0	80.0	90.0	100.0
Monetarily poor (%)	42.6	42.6	42.6	42.6	42.6	42.6	42.6	42.6	42.6	42.6
Multidimensionally poor (%)	81.6	69.4	60.2	51.6	41.4	32.9	22.6	14.9	8.3	2.7
Both (%)	*42.5*	*41.7*	*40.3*	*37.1*	*32.4*	*27.1*	*20.1*	*14.1*	*8.2*	*2.7*
Monetarily poor but multi-dimensionally non-poor (%)	0,09	0,87	2,27	5,51	10,20	15,50	22,49	28,46	34,43	39,88
Monetarily non-poor but multi-dimensionally poor (%)	39,07	27,64	19,84	14,53	8,98	5,84	2,47	0,75	0,16	0,00
Under-coverage rate (%)	*47.9*	*39.9*	*33.0*	*28.2*	*21.7*	*17.7*	*11.0*	*5.1*	*1.9*	*0.0*
Over-coverage rate (%)	*0.2*	*2.0*	*5.3*	*12.9*	*24.0*	*36.4*	*52.8*	*66.8*	*80.8*	*93.6*

Notes: The under-coverage rate is the proportion of individuals identified as multi-dimensionally poor but not as monetarily poor, with respect to the total number of multi-dimensionally poor individuals. The over-coverage rate is the proportion of individuals identified as monetarily poor, but not as multi-dimensionally poor, with respect to the total number of individuals identified as monetarily poor (Alkire and Seth, 2008, p. 18 ff.).

Table 2.5 also reports the calculation of over-coverage rate and under-coverage rate of the monetary measure. What do the results suggest? Assume, for example, a program of transfers to reduce multidimensional deprivations, with a k-value of 50%. In 2009, the most recent year of the analysis, 21.7% of the population would not be benefiting from this program despite being multi-dimensionally poor; and 23.9% would be benefiting without being multi-dimensionally poor.[38] Accordingly, to make poverty reduction more effective, the multidimensional approach would be more justified than the monetary approach, although both estimate a similar poverty rate. The same exercise and interpretation could be done for the other years and for different k-values.

2.5. Conclusions

In this essay, we estimated multidimensional poverty in Nicaragua between 2001 and 2009 using data from the three most recently available living standards surveys, and mainly following the methodology proposed by Alkire and Foster (2007, 2011a). Our key goal was to present empirical evidence that contributes to the discussion of these issues in the region and supports the adoption of a broader measurement methodology for the case of Nicaragua. Overall, the results of this essay overwhelmingly support the adoption of a multidimensional approach to poverty measurement in Nicaragua; they also demonstrate the value added of this approach, and they are more consistent with the Nicaraguan reality than the results of the multidimensional poverty index (global MPI), for example. Naturally, all of the assumptions adopted in this essay are debatable and can be improved upon.

Both the monetary and the multidimensional approach agree with the fact that the proportion of poor people in Nicaragua declined between 2001 and 2009. Nonetheless, an analysis of each of the sub-periods separately reveals great disparity between one approach and the other. Between 2001 and 2005, the official figures suggest a 2.5 percentage point increase in poverty, whereas the estimations made in this essay suggest a reduction of between 5.4 and 3.5 points, depending on the weightings used. Moreover, although both approaches agree with the fact that poverty declined in Nicaragua between 2005 and 2009, the monetary approach shows faster progress in this period than the multidimensional approach, in both absolute and relative terms.

[38] In 2009, with a k-value of 50%, the percentages of monetarily poor and multi-dimensionally poor are very similar.

In the context of the Alkire and Foster methodology, the results of this essay suggest, robustly, that the incidence, intensity and severity of multidimensional poverty in Nicaragua declined between 2001 and 2009, and more intensively in the first half of this period. The fact that this again is diametrically contrary to what is suggested by the official figures raises doubts about the official measure (and methodology). Moreover, a breakdown of the adjusted headcount ratio (M_0) shows that income deprivation is in no way among the largest contributors to overall multidimensional poverty, which reaffirms the belief that income is not everything. In addition, the results of the essay reveal that if the traditional measurement approach is used to identify the multi-dimensionally poor, a non-negligible error would be committed, either of type-I or of type-II.

Consequently, the recommendation is that the design, evaluation and monitoring of poverty reduction policies should not be exclusively based on a monetary approach, but should be supported with a broader measure that incorporates other important dimensions of the well-being of the Nicaraguan population. The results of the essay also suggest that, to be more effective, policies and program should not only be targeted on increasing income, but they should also aim at promoting clean domestic energy and a structural and competitive improvement in housing.

2.A. Appendix

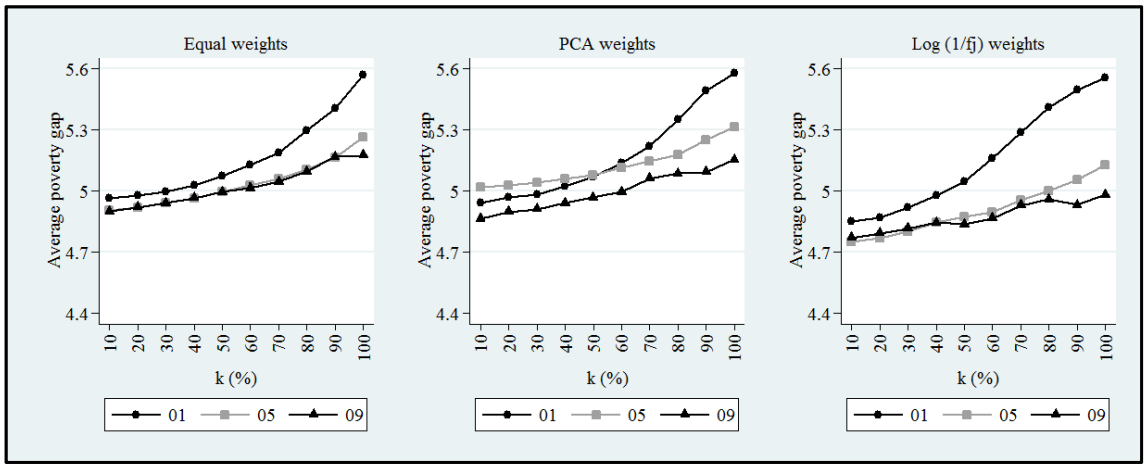

Figure 2.A.1: Average poverty gap (G) for different k-values, with three weighting structures and for 2001, 2005 and 2009.
Source: Authors' estimates based on data from the National Households Survey on Living Standards Measurement (EMNV) of 2001, 2005 and 2009.
Note: Survey weights used.

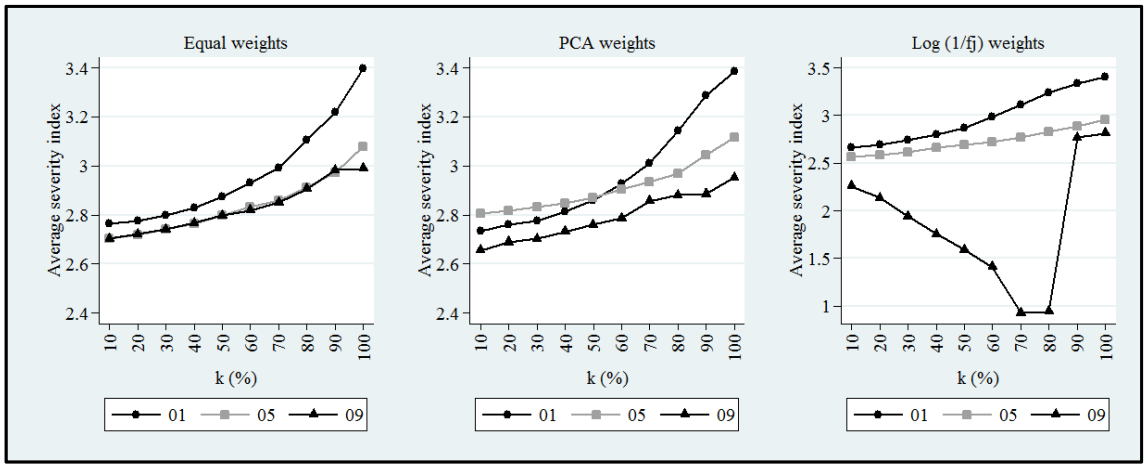

Figure 2.A.2: Average severity index (S) for different k-values, with three weighting structures and for 2001, 2005 and 2009.
Source: Authors' estimates based on data from the National Households Survey on Living Standards Measurement (EMNV) of 2001, 2005 and 2009.
Note: Survey weights used.

3. Gender and multidimensional poverty in Nicaragua: an individual based approach[39]

Abstract

Most existing multidimensional poverty measures, such as the global-MPI and the MPI-LA, use the household as the unit of analysis, which means that the multidimensional poverty condition of the household is equated with the multidimensional poverty condition of all its members; accordingly, these measures ignore the intra-household inequalities and are gender-insensitive. Gender equality is, however, at the center of the sustainable development, as emphasized by Goal 5 of the SDGs; therefore, individual based measures are indispensable to track progress in reaching this Goal. We contribute to the literature on multidimensional poverty and gender inequality by proposing an individual-based multidimensional poverty measure for Nicaragua and estimate the gender gaps in the three I's of multidimensional poverty (incidence, intensity, and inequality). Overall, we find that in Nicaragua, the gender gaps in multidimensional poverty are lower than 5%, and poverty does not seem to be feminized. However, the inequality among the multi-dimensionally poor is clearly feminized, especially among adults, and women are living in very intense poverty when compared to men. We also find that adding a dimension (employment, domestic work, and social protection) under which women face higher deprivation into the analysis leads to larger estimates of the incidence, intensity, and inequality of women's poverty. Finally, we find evidence that supports earlier studies that challenge the notion that female-headed households are worse off than those led by males in terms of poverty.

[39] The chapter is based on joint work with Stephan Klasen. A similar version of this Essay is published in *World Development* [https://doi.org/10.1016/j.worlddev.2018.06.016]. Preliminary versions of this essay were presented at the 2016 Development Economics Conference ("Göttinger Schule"), in Goettingen, at the 2016 Human Development & Capability Association Conference, in Tokyo, at the 2016 Development Studies Association Conference, in Oxford, at the 2017 PEGNet Conference, in Zurich, at the XXV Public Economics Meeting (2018), in Valencia, and at the Goettingen Development Economics Seminars, as well as at the Graduate Seminar in Applied Statistics and Econometrics, in Goettingen. We are grateful to participants in these academic events for helpful comments and discussions on the topic, especially to Sabina Alkire, Stefan Klonner, Thomas Kneib, Keetie Roelen, José Manuel Roche, A. Jesús Sánchez-Fuentes, Jacques Silber, and two anonymous referees. José Espinoza-Delgado would also like to acknowledge financial support by the German Academic Exchange Service.

3.1. Introduction

Poverty is one of the major sources of unfreedom (Sen, 2000a); it can involve not only the absence of necessities of material well-being but also the negation of possibilities of living a decent life (Anand & Sen, 1997). The removal of poverty is consequently a central goal of development and remains at the top of the world's development agenda, as it is reflected by the 2030 Agenda for Sustainable Development adopted by the United Nation General Assembly on September 25th, 2015: "End poverty in all its forms everywhere" [Goal 1 of the Sustainable Development Goals (SDGs)] (UN, 2015b, p. 15).

As the Goal 1 of the SDGs indicates, the conceptual understanding of poverty has been enhanced and deepened considerably in the past decades, grounded especially on Amartya Sen's influential work on his capability approach (Thorbecke, 2008)[40], and there is currently a widespread consensus that poverty is a multidimensional phenomenon (Atkinson, 2003; Stiglitz, Sen, & Fitoussi, 2009a, 2009b). Accordingly, poverty analysis and its measurement should not be based solely on income since this monetary indicator is unable to capture key well-being dimensions such as, for example, life expectancy, the provision of public goods, literacy, security, and freedom (Bourguignon & Chakravarty, 2003; Chakravarty & Lugo, 2016; Kakwani & Silber, 2008a; Whelan, Nolan, & Maître, 2014); as noted by Sen (2000b, p. 18): "Human lives are battered and diminished in all kinds of different ways". As a result of this awareness, poverty research has shifted the emphasis from a unidimensional to a multidimensional approach (Chakravarty & Lugo, 2016; Duclos & Tiberti, 2016; Pogge & Wisor, 2016), which has been considered by Kakwani & Silber (2008a) as "the most important development of poverty research in recent years" (p. xv), and diverse approaches have been proposed in the literature to the measurement of poverty in a multidimensional setting.[41]

Yet, it should be mentioned that there does not seem to be a universal agreement on whether the multiple dimensions of poverty should be brought together into a single measure (Lustig, 2011); for example, Ravallion advocates a dashboard approach, although he also

[40] See, for instance, Sen (1984, 1985, 1992, 1993, 2000a, 2008).

[41] See, for instance, Alkire and Foster (2011a); Alkire, et al. (2015); Atkinson (2003); Bourguignon and Chakravarty (2003); Chakravarty, Deutsch, and Silber (2008); Deutsche and Silber (2005); Duclos, Sahn, and Younger (2008); Kakwani and Silber (2008b); Klasen (2000); Lemmi and Betti (2006, 2013); Rippin (2013, 2016, 2017); Tsui (2002).

recognizes that poverty is multidimensional (Ravallion, 2011).[42] Particularly, in this essay, we start from the premise that a composite index and a dashboard approach can be complementary; there is no reason to choose between them (Ferreira & Lugo, 2013). The latter might be particularly useful for policy purposes, while the former is helpful to take advantage of the information from the joint distribution of deprivation, when the target is, as in our case, to quantify the incidence of many deprivations within the same individuals (Yalonetzky, 2014).

On the other hand, most existing empirical investigations concerned with multidimensional poverty analysis have used the household as the unit of analysis (Bessell, 2015; Franco, 2017; Klasen & Lahoti, 2016; Pogge & Wisor, 2016; Rogan, 2016a), meaning that the household has been utilized to determine who is multi-dimensionally poor and who is not. The general adopted assumption has been that all persons in the household are multi-dimensionally poor if the household is identified as such; that is, the multidimensional poverty condition of the household has been equated with the multidimensional poverty condition of all individuals in the household (Klasen & Lahoti, 2016). Poverty is, however, a characteristic of individuals, not households (Deaton, 1997), and, furthermore, perhaps the most relevant thing, such an assumption overlooks important within-household features and ignores the intra-household inequalities that have been suggested to exist: much of the inequalities are generated within households (Asfaw, Klasen, & Lamanna, 2010; Bradshaw, 2002, 2013; Bradshaw, Chant, & Linneker, 2017a, 2017b; Chant, 2008; Klasen & Wink, 2002; 2003; Rodríguez, 2016). In addition, potential inequalities among different age groups living in the same household (e.g., inequalities between children and adults) would be also hidden when such an entity is used as the unit of analysis (Atkinson, Cantillon, Marlier, & Nolan, 2002), which might lead to underestimations of the extent of overall poverty and inequality in the society and, in turn, to biased assessments of social policies and targeting (Deaton, 1997; Rodríguez, 2016).

In addition to the stated above, within-household inequality is a significant problem that deserves fuller research, especially because of its impact on the analysis of poverty by gender (Atkinson et al., 2002); as observed by Sen (2000a, p. 15), "inequality between women and men afflicts–and sometime prematurely ends– the lives of millions of women,

[42] For more information about this discussion, see Alkire and Foster (2011b); Lustig (2011); and Ravallion (2011).

and, in different ways, severely restricts the substantive freedoms that women enjoy". Yet, multidimensional poverty measures that take the household as the unit of identification of the poor are not sensitive to gender either; they are gender-blind and, consequently, incapable of revealing gender differentials within the households (Bessell, 2015; Pogge & Wisor, 2016). By definition, households with both a female and a male cannot contribute to a gender gap in poverty (Wiepking & Maas, 2005); therefore, a gender difference cannot be estimated, and a gender analysis cannot be performed using household-based measures.

Gender equality is at the center of sustainable development as well (ECLAC, 2016), as it is demanded by the SDGs: "Achieve gender equality and empower all women and girls" (Goal 5 of the SDGs) (UN, 2015b, p. 14). There are many intrinsic and instrumental grounds to be concerned about existing gender inequalities in different well-being-related dimensions (Klasen & Lamanna, 2009).[43] On one hand, from a well-being and equity view, gender inequalities diminish the individuals' well-being and are a form of injustice (Klasen, 2007, 2002; Klasen & Wink, 2003); on the other hand, from an instrumental perspective, gender inequalities have an impact on economic growth and development economics (Klasen, 1999, 2006; Klasen & Lamanna, 2009). However, for the reasons discussed previously, assessments of gender inequalities cannot be based on household-based measures; individual-based measures are therefore indispensable to track progress in reaching the Goal 5 of the SDGs (Bradshaw, Chant, & Linneker, 2018).

Although, in principle, assessing individual-based poverty seems to be more feasible in a non-income multidimensional framework than in a monetary one (Klasen, 2007), since attainments in many non-monetary dimensions such as education and health can be ascribed to individuals and the information on these attainments are often available in the household surveys, most popular multidimensional poverty measures such as the Multi-dimensional Poverty Index (global-MPI)[44] are estimated at the household level (Duclos & Tiberti, 2016); they are therefore not sensitive to the intra-household distribution of deprivation and thus are

[43] There are considerable and persistent gender differences in many indicators of well-being across the world. They include gender gaps in control over economic resources, education, earnings, mortality, access to employment, pay, time use, safety, and power in the public and the private sphere (Klasen, 2007). As noted by Klasen (2007, p. 167), "perhaps the most egregious form of gender inequality is that of gender inequality in survival in parts of the developing world, most notably South Asia and China where millions of females are "missing" as a result of these inequalities".

[44] The global-MPI has been developed by the Oxford Poverty and Human Development Initiative (OPHI) in collaboration with the Human Development Report Office of the United Nation Development Program (UNDP) (Alkire & Santos, 2014). Since 2010, it has been included in the Human Development Reports.

unable to measure gender differentials in deprivation and individuals' multidimensional poverty (Pogge & Wisor, 2016). In fact, in the literature on multidimensional poverty analysis, only a few papers have assessed individuals' multidimensional poverty, as well as gender differences, but the vast majority of them have been focused on a specific population subgroup, such as children (e.g. Roche, 2013; Rodríguez, 2016; Roelen, Gassmann, & de Neubourg, 2010, 2011), women (e.g. Alkire et al., 2013; Bastos, Casaca, Nunes, & Pereirinha, 2009; Batana, 2013), and adults (e.g. Agbodji, Batana, & Ouedraogo, 2015; Bessell, 2015; Mitra, Posarac, & Vick, 2013; Pogge & Wisor, 2016; Rogan, 2016a; Vijaya, Lahoti, & Swaminathan, 2014); that is, they have not evaluated multidimensional poverty at the individual level for the whole population.

As far as we know, there are only two papers that have assessed individual-based multidimensional poverty across the entire population. The first one is the work by Klasen and Lahoti (2016), who propose a framework to measure multidimensional poverty and inequality at the individual level. They find that in India, multidimensional poverty among females is 14 percentage points larger than among males when using an individual-based measure, but it is only 2 percentage points higher when employing a household-based one; they also suggest that in India, the neglect of intra-household inequality underestimates poverty and inequality in deprivation by some 30%. The second one is the work by Franco (2017), who constructs an individual-centered multidimensional poverty index considering three age groups, children (less than 18 years old), adults (between 18 and 59 years), and elderly (60 years or older), and uses it to estimate multidimensional poverty in Chile, Colombia, Ecuador, and Peru. She finds that Chile is the country with the best performance in poverty and, overall, the elderly, as opposed to the children, is the worst off age group; she also finds that in Chile, Colombia, Ecuador, and Peru, a household-based measure is consistently larger than and individual-based one. But, unlike the previous paper, a gender analysis is missing in Franco's work as well as an inequality analysis.

Given the lack of individual-based poverty analysis, gender inequality has often been assessed by comparing the poverty status of female-headed households against that of male-headed households,[45] and the proportion of poor households headed by females has been broadly adopted as a measure of women's poverty (Bradshaw et al., 2017a, 2017b, 2018;

[45] See, e.g., Altamirano and Teixeira (2017); Buvinić and Grupta (1997); Chant (1997, 2004); Drèze and Srinivasan (1997); Klasen et al. (2015); Rogan (2013, 2016a, 2016b).

Fukuda-Parr, 1999). However, despite the abundance of reasons why households led by a female may suffer more from deprivation and poverty, empirical evidence on the correlation between poverty and headship is ambiguous (Klasen, Lechtenfeld, & Povel, 2015), and women's multidimensional poverty seems to have nothing to do with household headship (Klasen & Lahoti, 2016).

Consequently, in this essay, we open the "black box" that is the household (Jenkins, 1991, p. 457) and propose an individual-based multidimensional poverty framework in order to overcome some of the shortcomings of the existing household-based measures. Employing data from Nicaragua, we use such a framework to estimate multidimensional poverty and inequality, as well as the corresponding gender gaps in this country; to do this, we apply the methodology proposed by Alkire and Foster (2011a) and the Correlation-Sensitive Poverty Index (CSPI) proposed by Rippin (2013, 2016, 2017), which is an inequality-sensitive multidimensional poverty index, as well as the absolute inequality measure proposed by Alkire and Seth (2014a). We also explore the determinants of multidimensional poverty in this Central American country by estimating logit regressions. It is worthy of note that Nicaragua is an interesting study case because it is the multi-dimensionally poorest country in Latin America and the Caribbean (Duryea & Robles, 2017; Santos & Villatoro, 2018) and, at the same time, according to the Global Gender Gap Index 2017, it is the best-performing country in that region for the sixth year running (World Economic Forum, 2017).

To the best of our knowledge, this essay constitutes the first effort in Latin America and the Caribbean region to estimate gender differences in multidimensional poverty and inequality for the whole population of a country, the first one that applies the CSPI there, and one of the first attempts in the literature on multidimensional poverty analysis. The essay includes five sections. The next section introduces the data and the methodological strategy used. Section 3 presents and discusses the results of the empirical analysis, and Section 4 shows extensive robustness analyses. The last section concludes by discussing the main findings and limitations of the essay.

3.2. Data and methodology

3.2.1. Data

The dataset analyzed is drawn from the most recent available household survey from Nicaragua: *Encuesta Nacional de Hogares sobre Medición de Nivel de Vida 2014* (2014-EMNV hereafter), conducted by the National Institute of Development Information with support from the World Bank in late 2014. The survey is nationally representative and contains information, among others, on housing, household composition, health, education, employment, income, and expenditures; in addition, it is the one used by the Government of Nicaragua to produce official estimates of poverty and inequality (INIDE, 2015, 2016). In our analysis, we include the household members who completed a full interview (29,381 people).[46]

The unit of identification of the multi-dimensionally poor is the individual. As methodological strategy, the population is divided into four age groups: children (<6 years old), adolescents (between 6 and 17 years), adults (between 18 and 59 years), and elderly (60 years or older). To mark the boundaries of the groups, three criteria have been considered. First, the definition of early childhood in the National Early Childhood Policy of the National Reconciliation and Unity Government of Nicaragua: individuals under 6 years old) (GRUN, 2011); second, the definition of children in the Convention on the Rights of the Child: "Every human being below the age of eighteen years" (UN, 1989, p. 2); and, third, the legal age of retirement in Nicaragua: 60 years old, except for formal education teachers, which is 55 years.[47] Table 3.1 shows the sample size by group and gender, its representation at national level, and the population share, which is used to obtain the overall estimates. Note that in Nicaragua, adolescents and adults represent roughly 80% of the whole population, which means that the national achievements are highly influenced by the performance of these groups.

[46] It is worth mentioning that many of the insights of gender scholars have come through small-scale surveys that interview males and females separately within the household (see, for instance, Bradshaw 2002, 2013, on Nicaragua), but not in the presence of each other, since responses of females can be influenced by the male presence; however, we do not have any evidence to assert that the survey has followed these data collecting conventions. On average, 2.21 men and 2.33 women were interviewed in each household; but, the survey does not, for example, provide information on the level of disagreement between males and females around who makes decisions over assets.

[47] According to the Article 55 of the "Reglamento general de la ley de seguridad social de Nicaragua" (Decreto No. 975, 1982). We also follow the general tradition in Latin America and the Caribbean to define "older people" as those individuals aged 60 or more (Gasparini, Alejo, Haimovich, Olivieri, & Tornarolli, 2010, p. 177).

Table 3.1: Sample size by age group and gender, population, and population share.
Source: Author's estimates based on 2014-EMNV.

Group	Gender	Sample	Population	Pop. Share (%)
Children	Male	1,832	396,932	6.4
	Female	1,775	397,681	6.4
	Sub-total	*3,607*	*794,613*	*12.7*
Adolescents	Male	3,592	784,898	12.6
	Female	3,459	746,148	12
	Sub-total	*7,051*	*1,531,046*	*24.5*
Adults	Male	7,586	1,615,795	25.9
	Female	8,688	1,793,015	28.7
	Sub-total	*16,274*	*3,408,810*	*54.6*
Elderly	Male	1,093	243,033	3.9
	Female	1,356	263,405	4.2
	Sub-total	*2,449*	*506,438*	*8.1*
The Whole Population	Total	29,381	6,240,907	100

3.2.2. Multidimensional poverty measures

We use the counting methodology proposed by Alkire and Foster (2011a) (henceforth "AF"), an axiomatic family of multidimensional poverty measures, to estimate individual-based multidimensional poverty.[48] This methodology certainly offers the advantage of being very simple, flexible, and clear when compared to other multidimensional methodologies (Silber, 2011; Thorbecke, 2011);[49] it also satisfies a number of desirable properties and explicitly takes the joint distribution of deprivations into account. Nonetheless, it should be mentioned that despite its widespread acceptance, the AF methodology has some serious drawbacks (Rippin, 2010, 2012, 2017; Silber, 2011; Duclos & Tiberti, 2016; Pogge & Wisor, 2016). For instance, as observed by Rippin (2012, 2017), it assumes indirectly that up to the multidimensional poverty line (k) the poverty dimensions are perfect substitutes while they are considered to be perfect complements from k onwards, which is difficult to justify theoretically. Additionally, with ordinal data, the AF measure is insensitive to inequality among the poor (Silber & Yalonetzky, 2014). Therefore, for comparison purposes, we also estimate the Correlation Sensitive Poverty Index proposed by Rippin (2012, 2013, 2017), which is sensitive to inequality among the multi-dimensionally poor.

[48] A systematic overview of this methodology can be found in Alkire, et al. (2015).

[49] Other methodologies can be found, e.g., in Lemmi and Betti (2006, 2013); and Kakwani and Silber (2008).

3.2.2.1. The AF Methodology

Let n represent the individuals and let $d \geq 2$ be the number of indicators under analysis.[50] Let $X = [x_{ij}]$ denote the $n \times d$ achievement matrix, where $x_{ij} \geq 0$ $(x_{ij} \in \mathbb{R}_+)$ is the achievement of individual i in indicator j.[51] For each indicator j, a deprivation cutoff z_j is set. Let $z = (z_1, \dots, z_d)$ be the row vector that collects the deprivation cutoffs. Given x_{ij}, if $x_{ij} < z_j$, the i^{th} individual is identified as deprived in j. From the X matrix and the z vector, a matrix of deprivation $g^0[g_{ij}^0]$ is obtained such that $g_{ij}^0 = 1$ if $x_{ij} < z_j$, and $g_{ij}^0 = 0$ when $x_{ij} \geq z_j$, for all $j = 1, \dots, d$ and for $i = 1, \dots, n$. Let $w = (w_1, \dots, w_d)$ be the vector of weights that reveals the relative importance of each indicator $(w_j > 0 \; and \; \sum_1^d w_j = 1)$. A deprivation score for individual i (c_i) is obtained by adding their weighted deprivations up: $c_i = \sum_{j=1}^d w_j g_{ij}^0 = \sum_{j=1}^d \bar{g}_{ij}^0$. If individual i is not deprived in any indicator $c_i = 0$; conversely, $c_i = 1$ when the individual is deprived in all indicators. The vector of deprivation scores for all individuals is $c = (c_1, \dots, c_n)$.

To identify the poor, a cutoff level for c_i is used. Let k denote "the poverty cutoff" that represents the least deprivation score an individual needs to show in order to be deemed as multi-dimensionally poor (Alkire and Foster, 2011a, p. 478). The poverty cutoff is implemented by using the method of identification ρ_k that identifies individual i as poor when their deprivation score is at least k. Formally, $\rho_k(x_{i.}; z) = 1$ if $c_i \geq k$, and $\rho_k(x_{i.}; z) = 0$, otherwise.[52] From the deprivation matrix $g^0[g_{ij}^0]$, a censored deprivation matrix $g^0(k)$ is constructed by multiplying each element in g^0 by the identification function $\rho_k(x_{i.}; z)$: $g_{ij}^0(k) = g_{ij}^0 \times \rho_k(x_{i.}; z)$ for all i and for all j. In the censored deprivation matrix, if $\rho_k(x_{i.}; z) = 1$, which means that individual i is multi-dimensionally poor, the deprivation status of i in every indicator does not change, and the row with their deprivation information remains the same as in g^0. But, if i is not poor, meaning that $\rho_k(x_{i.}; z) = 0$, their deprivation information is censored, and a vector of zeros is assigned. Similarly, a censored deprivation score vector for all individuals is obtained from the original deprivation score vector:

[50] This section is based on the essay 5 of the book *Multidimensional poverty measurement and analysis* (Alkire et al., 2015, pgs. 144-185).

[51] Each row vector $x_i = (x_{i1}, \dots, x_{id})$ gives individual i's achievements, while each column vector $x_j = (x_{1j}, \dots, x_{nj})$ provides the distribution of achievements in indicator j across the set of individuals.

[52] It is worth noting that ρ_k includes the union and intersection approaches as particular cases where $k \leq \min\{w_1, \dots, w_d\}$ and $k = 1$, respectively. The AF methodology suggests to set k somewhere between these two extremes (Alkire & Foster, 2011a).

$c(k) = c \times \rho_k(x_{i.}; z)$; it is also possible to derive it from $g_{ij}^0(k)$. Let $c_i(k) = \sum_{j=1}^{d} w_j g_{ij}^0(k)$ be the censored deprivation score of individual i; by definition, $c_i(k) = c_i$ when $c_i \geq k$, and $c_i(k) = 0$, otherwise. Finally, $c(k) = [c_1(k), \dots, c_n(k)]$.

To solve the aggregation problem, the AF methodology proposes a family of multidimensional poverty measures M_α that is based on the FGT class of poverty measures (Foster, Greer, & Thorbecke, 1984, 2010). The first measure of this family is the adjusted headcount ratio $[M_0(X; z)]$ that is the mean of $c(k)$ and is given by:

$$M_0 = \mu\big(c(k)\big) = \frac{1}{n} \times \sum_{i=1}^{n} c_i(k) \qquad (3.a)$$

The adjusted headcount ratio can also be calculated as the product of two partial indices:[53] H, the multidimensional headcount ratio or the incidence of multidimensional poverty, and A, "the average deprivation score across the poor" or the intensity of poverty (Alkire et al., 2015, p. 157). Then:

$$M_0(X; z) = \mu\big(c(k)\big) = H \times A = \frac{q}{n} \times \frac{1}{q} \sum_{i=1}^{q} c_i(k) = \frac{1}{n} \sum_{i=1}^{n} c_i(k) = \frac{1}{n} \sum_{i=1}^{n} \sum_{j=1}^{d} w_j g_{ij}^0(k) \qquad (3.b)$$

We use M_0 to estimate multidimensional poverty in Nicaragua and also take advantage of two key properties of this measure: the "population subgroups decomposability" (Alkire, et al., 2015, p. 163), which allows assessing the subgroup contributions to overall poverty, and the breakdown property by indicator, which makes it possible to find out the contribution of each indicator to the overall poverty.

To evaluate inequality among the multi-dimensionally poor, an issue that has been neglected by almost all of the literature on multidimensional poverty measurement, we employ the "separate inequality measure" (I_q) proposed by Alkire and Seth (2014a, p. 3). Let q denote the number of multi-dimensionally poor, inequality can be computed as:

[53] M_0 can be understood as the proportion of deprivations that the multi-dimensionally poor experience, as a share of the deprivations that would be experienced if the whole population were multi-dimensionally poor and deprived in all the indicators considered (Alkire et al., 2015).

$$I_q = \frac{4}{q}\sum_{i=1}^{q}[c_i(k) - A]^2 \qquad (3.c)$$

For reasons stated previously, we also estimate the CSPI that takes into account the inequality among the multi-dimensionally poor and uses the union approach to identify the multi-dimensionally poor individuals (Rippin, 2013, 2016, 2017). It is computed as follows:

$$CSPI = \frac{1}{n}\sum_{i=1}^{n}\sum_{j=1}^{d}\left(w_j g_{ij}^0\right)^2 \qquad (3.d)$$

The CSPI can be decomposed into the three I's of poverty (incidence, intensity, and inequality) (Jenkins & Lambert, 1997); in fact, it is the only one multidimensional poverty index that allows such a decomposition (Rippin, 2012). The CSPI's decomposition is as follows:

$$CSPI = \frac{q}{n}\left(\frac{\sum_{i=1}^{n} c_i}{q}\right)^2 + 2\left(\frac{\frac{1}{2q}\sum_{i=1}^{n} c_i}{\frac{1}{q}\sum_{i=1}^{n} c_i}\right) = HA^2(1 + 2GE) \qquad (3.e)$$

To assess gender differences in poverty and inequality, we use "the sex/poverty ratio" presented by Mc Lanahan, Sørensen, and Watson (1989, p. 105). This is simply the ratio of the women's rate $(H, A, M_0, I_q, CSPI)$ to the men's one; therefore, it is a relative measure of the status of women and men.

3.2.3. Dimensions, indicators and deprivation cutoffs

The choice of dimensions and indicators reflects a normative decision in the design of any multidimensional poverty measure (Alkire et al., 2015); assuming this idea, and being conditioned by data availability, our individual-based multidimensional poverty measure comprises three equally weighted dimensions: education, health, and standard of living, which are clearly among the most significant aspects of well-being (Stiglitz et al., 2009a) and can be seen as basic or elemental capabilities (Sen, 1993, 2000a).[54] They are also the same used by the global-MPI (Alkire & Santos, 2014) and can be framed into the list proposed by

[54] As noted by Sen (1993, p. 41), "identifying a minimal combination of basic capabilities can be a good way of setting up the problem of diagnosing and measuring poverty".

Robeyns (2003) for gender inequality assessment. The dimensions and the indicators to be used to measure each of them, as well as the deprivation cutoffs, are shown in Table 3.2.

Table 3.2: Dimensions, indicators and deprivation cut-offs.

Dimension	Indicator	Deprivation indicators: he/she is deprived if he/she…
Education	Schooling achievement	(Children) is not attending nursery school or pre-school or primary school and the head of the household has not completed lower secondary school (Adolescents) is not on track to complete lower secondary school by 17 years old (Adults) has not completed lower secondary school (Elderly) has not completed lower secondary school
Health	Health functioning	(Children and Adolescents) has suffered from a chronic disease or eruptive disease or diarrhea or several diseases in the past four weeks (Adults and Elderly) has suffered from a chronic disease or several diseases in the past four weeks
Standard of Living	Housing	is living in a house with dirt floor and/or precarious roof (waste, straw, palm and similar, other precarious materials) and/or precarious wall materials (waste, cardboard, tin, cane, palm, straw, other precarious materials)
	People-per-bedroom	has to share bedroom with two or more people
	Housing tenure	is living in an illegally occupied house or in a ceded or borrowed house
	Water	does not have access to an improved drinking water source (public tap or standpipe, public or private well, piped water into dwelling, piped water to yard/plot)
	Sanitation	only has access to an unimproved sanitation facility (a toilet or latrine without treatment or a toilet flushed without treatment to a river or a ravine)
	Electricity	does not have access to electricity
	Energy	is living in a household which uses wood and/or coal and/or dung as main cooking fuel
	Assets	does not have access to one of the following assets: radio, TV, telephone, bicycle, motorbike, refrigerator, and does not have access to a car or a truck

3.2.3.1. Education

Not being effectively able to achieve an educational level certainly constitutes a "capability deprivation" (Sen, 2000a, p. 87).[55] Education has intrinsic value, being educated is a valuable achievement in itself, and the real opportunity to have it "can be of direct importance to a person's effective freedom" (Drèze & Sen, 2002, p. 39). It can also have a range of instrumental (personal and collective) roles (Robeyns, 2006). For instance, education can be crucial for finding and getting a decent job, for practicing of democracy, for enhancing

[55] This dimension has also been highlighted in the capability number four ("Senses, Imagination, and Thought") of "The Central Human Capabilities" proposed by Nussbaum (2003, p. 41).

disadvantaged people ability, and for decreasing of gender inequalities (Drèze & Sen, 2002). Therefore, its inclusion is widely justified.[56]

For children, we assess whether they are currently attending nursery school or pre-school or primary school; if not, since in Nicaragua school attendance is not mandatory for children under the age of 6 years, we also evaluate the schooling level of the head of the household where they live, as proxy for their potential level (Klasen & Lahoti, 2016). Specifically, children are deemed to be education deprived if they are not attending school and the household head has not completed at least lower secondary school (9 years of schooling).[57] Besides the fact that the Government of Nicaragua has a specific national policy addressed to early childhood (GRUN, 2011), the use of this information is supported by the rich and well-established literature that has pointed out the benefits of early childhood education (see, e.g., Barnett, 1995, 2002; Barnett & Ackerman, 2006; Bartik, 2014; Campbell, et al., 2014; Cunha, Heckman, & Schennach, 2010; Doyle, Harmon, Heckman, & Tremblay, 2009; Gamboa & Krüger, 2016; Gertler et al., 2013; Hayes, 2008; Hägglund & Pramling Sammuelson, 2009; Heckman, 2008, 2011; Nores & Barnett, 2010; Pramling Samuelsson 2011).[58] Of course, the chosen indicator does not capture the quality of early childhood education in Nicaragua, nor does it catch the level of knowledge achieved, nor skills, but it is the best option available to evaluate whether or not children "are being exposed to a learning environment" (Alkire & Santos, 2010, p. 14).[59]

For adolescents, we check whether they are on track to complete, at least, lower secondary school by 17 years old (9 years of schooling). In Nicaragua, the primary school entrance age is 6 years, so that adolescents are expected to complete lower secondary school by 15 years old; therefore, we provide a buffer of two years to account for delayed

[56] Furthermore, target 4.5 of the SDGs demands eliminating "gender disparities in education and ensure equal access to all levels of education and vocational training for the vulnerable, including persons with disabilities, indigenous peoples and children in vulnerable situations" (UN, 2015b, p. 17).

[57] The empirical evidence in Latin America has shown that there is a positive correlation between the young person's educational attainments and their parents' years of schooling: The proportion of young persons that finishes secondary school is over 60% when their parents have completed 10 or more years of schooling (Villatoro, 2007).

[58] Early childhood education can enormously increase the children's "cognitive abilities", especially for disadvantaged children (Barnett, 2002, p. 1); it can shape the children's "attitudes", "habits", and "identity throughout life" (Pramling Samuelsson & Kaga, 2010, p. 57) and can even prevent some diseases such as "cardiovascular and metabolic diseases" (Campbell et al., 2014, p. 1478). Further, "adolescents who have a good start in life are less likely to be poor as adults" (Hayes, 2008, p. 8).

[59] It is worth mentioning that the global-MPI requires all children 8 years old or older to attend school and considers children younger than that age as non-deprived (Alkire & Santos, 2014), which might lead to underestimating the dimensional deprivation rate.

progression, mainly in the rural areas. For instance, a person aged 9 years will be considered to be deprived in education if he or she is currently attending first grade of primary school. It is worth mentioning that in Nicaragua, only primary school (6 years of education) is mandatory, but our deprivation level is in line with target 4.1 of the SDGs, which calls for, by 2030, ensuring ‘‘that all girls and boys complete free, equitable and quality primary and secondary education leading to relevant and effective learning outcomes” (UN, 2015b, p. 17).

Finally, in order to be consistent in our analysis, we consider that adults and elderly are education deprived if they have not finished at least lower secondary school.[60]

3.2.3.2. Health

Health has also been identified as one of the “key” dimensions of well-being (Stiglitz, et al., 2009a, p. 14) and can be considered as a central capability (Nussbaum, 2003; Robeyns, 2003; Sen, 2000a). As education, health has intrinsic and instrumental value as well (Alkire & Santos, 2014); being healthy is not only a valuable achievement in itself, but also can help individuals to do many important things such as playing baseball, do swimming, and so on (Drèze & Sen, 2002). Health can also affect several others capabilities; for instance, being not healthy can limit an individual’s capability to take part in social activities and prevent them from practicing their profession (Rippin, 2016).

Due to data constraints, health has been the most challenging dimension to measure, as the health module of the 2014-EMNV is mainly aimed at collecting information about medical expenditure rather than obtaining information about direct indicators of health. For instance, a nutrition indicator, which is one of the two indicators used by the global-MPI,[61] cannot be included in our analysis, since the necessary information to construct it is not available in the dataset. However, the survey supplies information on whether individuals have suffered from a disease (s) in the last month; hence, we take advantage of that information to construct our indicator of health functioning failure, considering suffering from a chronic disease (s) as the core of the indicator. Children and adolescents are

[60] It is worthy of note that the multidimensional poverty index proposed recently for Latin America (MPI-LA) applies the same deprivation threshold for adults only; it demands primary school completion for the elderly (Santos & Villatoro, 2018). The global-MPI uses in turn as deprivation line “5 years of schooling” in the education dimension. We apply, therefore, a more demanding dimensional cutoff that is in line with the SDGs.

[61] The second indicator used by the global-MPI is child mortality, which assesses whether a child in the household has died. The nutrition indicator “identifies a person as deprived in nutrition if anyone in their household is undernourished using the weight-for-age indicator for adolescents and the Body Mass Index (BMI) for adults” (Alkire & Santos, 2014, p. 254).

considered to be deprived in health if they have suffered from a chronic disease or infectious disease (such as rubella, measles, chickenpox, and so on) or diarrhea or several diseases in the past month. Meanwhile, adults and elderly are identified as health deprived if they have suffered from a chronic disease or several diseases in the past month.[62]

3.2.3.3. Standard of living

The inclusion of a dimension of standard of living might be questionable under the capability approach framework. However, as noted by Sen (1984, p. 86), "living standard can be seen as freedom (positive freedom) of particular types, related to material capabilities"; moreover, there is empirical evidence that suggests that living standard indicators are those that contribute the most to multidimensional poverty, especially in poorer countries and in rural areas (Alkire et al., 2017; Alkire & Santos, 2014; Dotter & Klasen, 2017; Espinoza-Delgado & López-Laborda, 2017).

We use eight indicators to measure this dimension: housing, people-per-bedroom, housing tenure, water, sanitation, electricity, energy, and assets, which are closely linked with the functionings that they facilitate (Alkire & Santos, 2014). However, it is fair to say that there are both conceptual and empirical challenges in the construction of individual deprivations for such indicators (several of them are public in nature within the household) (Klasen & Lahoti, 2016; Vijaya, et al., 2014), as it is not possible to identify the ultimate beneficiary and determine with any certainty how much these indicators are used by one individual as opposed to another (Klasen, 2007); therefore, we suppose that those indicators are true public goods (non-rival and non-excludable) accessible equally to everyone within the household (Klasen & Lahoti, 2016; Vijaya, et al., 2014). Each individual is deemed to be deprived or non-deprived in each indicator based on the deprivation cut-offs defined in Table 3.2.

The first three indicators are used by the MPI-LA to measure the "housing dimension" (Santos & Villatoro, 2018, p. 59). The housing indicator assesses whether the individual is living in a dwelling with dirt floor and/or precarious roof and/or precarious wall

[62] Since our health indicator is based on a self-report assessment, there might be reporting bias in disease (s) prevalence. To address this, we have related deprivation rates in health to an assets index as well as to income quintiles. The results suggest that there is no an obvious reporting bias in health (see Tables 3.A.1 and 3.A.2 in Appendix 3.A).

materials.[63] People-per-bedroom indicator is concerned about overcrowding;[64] and housing tenure security evaluates whether the individual is living in an illegally occupied house or in a ceded or borrowed house.[65] The following two indicators concern water and sanitation, which are in line with Goal 6 of the SDGs that requires ensuring "availability and sustainable management of water and sanitation for all" (UN, 2015b, p. 18); both indicators are included by the global-MPI as well.[66] The sixth and seventh indicators, electricity and energy (main source of energy for cooking), are also considered by the global-MPI and MPI-LA and can be framed into Goal 7 of the SDGs: "Ensure access to affordable, reliable, sustainable and modern energy for all" (UN, 2015b, p. 19).[67] Finally, the dimension of standard of living includes an assets indicator, which covers ownership of some durable (consumer) goods and is similar to the one used by the global-MPI (Alkire and Santos, 2014).[68] It is worthy of note that due to data limitations, and as the global-MPI and the MPI-LA do, we implicitly assume that "access to" water, sanitation, electricity, and some durable goods implies an effective use of such items and, at the same time, guarantees the well-being that these bring. However, this assumption might be controversial as the individual's benefit depends on the quality, the quantity, the availability, and even, in some cases, the price of the service (Dotter & Klasen, 2017; Klasen, Lechtenfeld, Meier, & Rieckmann, 2012; Sorenson, Morssink, & Campos, 2011); likewise, having access to some assets does not ensure control over their use

[63] The quality of housing has instrumental and intrinsic value. It can affect directly or indirectly the health of individuals and can provide important safety elements (Shaw, 2004); additionally, it can also affect the well-being of the individuals directly (Klasen, 2000).

[64] Overcrowding is also related to the quality of housing; it can affect individuals' well-being and certainly does not contribute to a healthy environment. It can be an important factor in transmission of diseases, such as tuberculosis (Elender, Bentham, & Langford, 1998), and can be a cause of infant mortality (Cage & Foster, 2002).

[65] Housing tenure security is considered as a component of the right to adequate housing: "Housing is not adequate if its occupants do not have a degree of tenure security which guarantees legal protection against forced evictions, harassment and other threats" (OHCHR, 2009, p. 4).

[66] Additionally, water and sanitation are of considerable instrumental and intrinsic significance: "Adequate sanitation, together with good hygiene and safe water, are fundamental to good health and to social and economic development" (Mara, Lane, Scott, & Trouba, 2010, p. 1).

[67] In addition, having access to electricity can help improving living conditions of individuals by allowing them to be somewhat independent of sunlight and by contributing to a clean environment (Santos, 2013). The main source of energy for cooking is also included for its intrinsic and instrumental significance (Klasen, 2000). Indoor air pollution might have adverse effects on individuals' health and might increase the risk of many diseases and death (Duflo, Greenstone, & Hanna, 2008a, 2008b, 2016; Kaplan, 2010); it has also been considered as "a global health threat, particularly for women and young children" (Duflo, et al., 2008a, p. 7).

[68] An asset indicator also has instrumental significance since the goods considered can help individuals in maintaining contact with the surrounding world; they can also help to ease the work burden in and around the household and can contribute to improving individuals' health (Klasen, 2000).

(Agarwal, 1994, 1997; Bradshaw, 2002, 2013; Bradshaw et al., 2017b; Brickell & Chant, 2010).

3.2.3.4. An enhanced multidimensional poverty index

In order to shed some light on the role the institutions play in driving gender gap in multidimensional poverty in Nicaragua, in addition to the three-dimensional index, we also estimate a four-dimensional one for adults, where gender tensions might be highest (ECLAC, 2016), and for elderly, who might be the most vulnerable group (Gasparini et al., 2010). Considering what is available in the survey, we add a fourth dimension to the previous index, which incorporates information on deprivation in employment (for adults) and access to social protection (for elderly).[69] This fourth dimension captures important aspects of well-being that are relevant for Nicaragua, and also for Latin America and the Caribbean (Gasparini et al., 2010; Santos & Villatoro, 2018), under which there might be substantial gender gaps (Robeyns, 2003).[70] An adult is considered to be deprived in employment if he or she is unemployed, employed without a pay, a discouraged worker or hidden unemployed, an unpaid domestic worker (he or she is unemployed but is not looking for a job because he/she has to take care of his/her children and/or a relative (s) and/or has to do domestic work).[71] For its part, an elderly person is identified as deprived in social protection if he or she has no access to any form of income, such as, for instance, pension, retirement income, and work income.

---

[69] The 2014-EMNV only provides information on these topics for individuals aged 10 years or older; therefore, besides the justification stated, we focus on adults and elderly in order to be consistent with the age groups defined. Notwithstanding, it must be recognized that in Nicaragua, child labor or children engaged in domestic work is common, especially in rural areas, which could be harmful to children's health and human capital accumulation (ILO, 2017; Rosati & Rossi, 2003), and substantial gender gaps might be found, mainly in children's allocation of time and in household chores (Dammert, 2010; ILO, 2017).

[70] This fourth dimension can be framed both in Goal 8, and its targets, of the SDGs: "Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all" (UN, 2015b, p. 14), and in target 5.4 of such Goals: "Recognize and value unpaid care and domestic work through the provision of public services, infrastructure and social protection policies and the promotion of shared responsibility within the household and the family as nationally appropriate" (p. 18).

[71] Due to the fact that the survey does not include a time use module, we consider as non-deprived in employment those individuals that have a paid work as well as an unpaid domestic work. This assumption is likely to underestimate the women's deprivation level and, consequently, the gender gap in the dimension, as women's unequal burdens of unpaid domestic work "can often lead to exacting demands and women's relative time poverty" (Bradshaw et al., 2017b, p. 4).

Table 3.3: Spearman Correlation Coefficients between Deprivations, by Group.
Source: Authors' estimates based on 2014-EMNV.

Indicator	Group	Education	Health	Housing	P. Bedroom	H. Tenure	Water	Sanitation	Electricity	Energy	Assets
	Children	.264***	-.049***	.345***	.295***	-.009***	.283***	.292***	.314***	.432***	.397***
	Adolescents	.230***	.012***	.382***	.352***	.015***	.228***	.298***	.342***	.470***	.398***
Income	Adults	.290***	-.059***	.379***	.335***	.029***	.235***	.275***	.299***	.468***	.410***
	Elderly	.214***	-.025***	.423***	.397***	.040***	.137***	.275***	.394***	.450***	.450***
	The whole population	.233***	-.045***	.382***	.345***	.025***	.238***	.287***	.322***	.465***	.410***
	Children		.024***	.237***	.132***	-.041***	.213***	.197***	.213***	.352***	.264***
	Adolescents		-.003***	.190***	.151***	.062***	.191***	.176***	.275***	.261***	.240***
Education	Adults		.040***	.339***	.235***	.056***	.211***	.281***	.247***	.438***	.341***
	Elderly		-.020***	.261***	.184***	.044***	.134***	.232***	.158***	.367***	.286***
	The whole population		.084***	.255***	.159***	.028***	.178***	.217***	.222***	.347***	.281***
	Children			.049***	-.019***	.008***	.005***	.022***	.014***	.041***	.026***
	Adolescents			.004***	.035***	-.006***	-.017***	.012***	.010***	.029***	.030***
Health	Adults			-.072***	-.055***	-.041***	-.040***	-.051***	-.053***	-.060***	-.044***
	Elderly			-.092***	-.013***	-.007***	-.031***	-.045***	-.079***	-.107***	-.018***
	The whole population			-.050***	-.052***	-.042***	-.035***	-.032***	-.033***	-.035***	-.012***
	Children				.354***	.054***	.277***	.325***	.318***	.486***	.409***
	Adolescents				.356***	.075***	.244***	.326***	.300***	.486***	.405***
Housing	Adults				.384***	.106***	.278***	.366***	.334***	.511***	.431***
	Elderly				.383***	.088***	.293***	.406***	.386***	.512***	.498***
	The whole population				.378***	.094***	.273***	.356***	.329***	.504***	.428***
	Children					.131***	.178***	.250***	.234***	.265***	.289***
	Adolescents					.113***	.127***	.246***	.237***	.277***	.293***
P. Bedroom	Adults					.153***	.158***	.264***	.234***	.312***	.304***
	Elderly					.069***	.152***	.249***	.222***	.318***	.310***
	The whole population					.144***	.159***	.261***	.238***	.303***	.302***

Note: Significance levels: *p < 0.1; **p < 0.05; ***p < 0.01.

Table 3.3-(*continued*)

Indicator	Group	Education	Health	Housing	P. Bedroom	H. Tenure	Water	Sanitation	Electricity	Energy	Assets
	Children						.011***	.086***	.048***	.021***	.095***
	Adolescents						.072***	.125***	.068***	.075***	.089***
H. Tenure	Adults						.080***	.140***	.082***	.077***	.115***
	Elderly						.056***	.130***	.040***	.076***	.112***
	The whole population						.070***	.131***	.073***	.071***	.106***
	Children							.293***	.478***	.323***	.327***
	Adolescents							.284***	.415***	.304***	.333***
Water	Adults							.287***	.417***	.307***	.335***
	Elderly							.261***	.381***	.293***	.291***
	The whole population							.288***	.425***	.310***	.332***
	Children								.263***	.368***	.300***
	Adolescents								.243***	.377***	.313***
Sanitation	Adults								.235***	.416***	.316***
	Elderly								.183***	.490***	.356***
	The whole population								.240***	.408***	.318***
	Children									.373***	.468***
	Adolescents									.354***	.461***
Electricity	Adults									.355***	.464***
	Elderly									.355***	.404***
	The whole population									.359***	.460***
	Children										.483***
	Adolescents										.496***
Energy	Adults										.512***
	Elderly										.539***
	The whole population										.508***

Note: Significance levels: *p < 0.1; **p < 0.05; ***p < 0.01.

3.2.4. Association between indicators

Table 3.3 displays the Spearman's rank correlation coefficients between the indicators of deprivation (0-1), which have been constructed using the deprivation cut-offs shown in Table 3.2. For comparison purposes, an income deprivation indicator (0-1) is also included in the table, which has been estimated employing the official "Overall Poverty Line (OPL)" (INIDE, 2015, p. 8).[72] Overall, we find that there are weak correlations between the indicators considered in our analysis.

It can be seen, firstly, that there is a comparatively low correlation between deprivation in education and deprivation in the other indicators. This might be due to the fact that other factors, such as self-motivation, individual abilities, expectations about the rewards from education (Eckstein & Wolpin, 1999), parent's education level (Belzil & Hansen, 2003), "family background" (Cameron & Heckman, 2001, p. 492), could have a greater impact on schooling achievement. Secondly, health functioning is very weakly related to the other indicators; this might be due to the fact that chronic disease prevalence is strongly related to behavioral factors and bad luck which are less correlated with overall deprivation (Fine, Philogene, Gramling, Coups, & Sinha, 2004). Finally, it is worth noting that income is moderately correlated with all the other indicators; excluding energy and assets, it exhibits correlations below 0.40. Consequently, a more holistic approach for the measurement of poverty seems to be justified.

3.3. Results

3.3.1. Aggregate deprivation by indicator

We first evaluate the aggregate deprivation levels for each indicator before computing the multidimensional poverty and inequality measures. Figure 3.1 depicts the estimated proportion of people deprived in each of the ten indicators used ("the uncensored headcount ratio") (Alkire et al., 2015, p. 236);[73] the proportion of the monetarily poor is also displayed as a reference level (dash lines), which has been estimated by using the official "overall

[72] The value of 2014 OPL is estimated at a consumption level of C$ 17,011.47 annual per capita (INIDE, 2015). Assuming a year of 365 days and based on the official average exchange rate for 2014 (C$ 25.96 per American dollar, US $), published on the World Bank's website (http://data.worldbank.org/indicator/PA.NUS.FCRF?locations=NI), the 2014 OPL is equivalent to 1.80 dollars a day.

[73] The point estimates, as well as its confidence intervals at 95 percent, can be found in Tables 3.A.3 and 3.A.4 in Appendix 3.A.

poverty line" (C$ 17,011.47 Nicaraguan Córdobas, approximately equivalent to 1.80 dollars a day at the official average exchange rate for 2014) (INIDE, 2016, p. 27). On the whole, it can be observed that, although the deprivation levels are different among the age groups, the deprivation profiles are quite similar. The results show that in Nicaragua, there are several indicators in which deprivation is larger than that of the income, confirming the necessity of shifting from the monetary approach, the official one, to a broader poverty analysis, as suggested by Espinoza-Delgado & López-Laborda (2017).

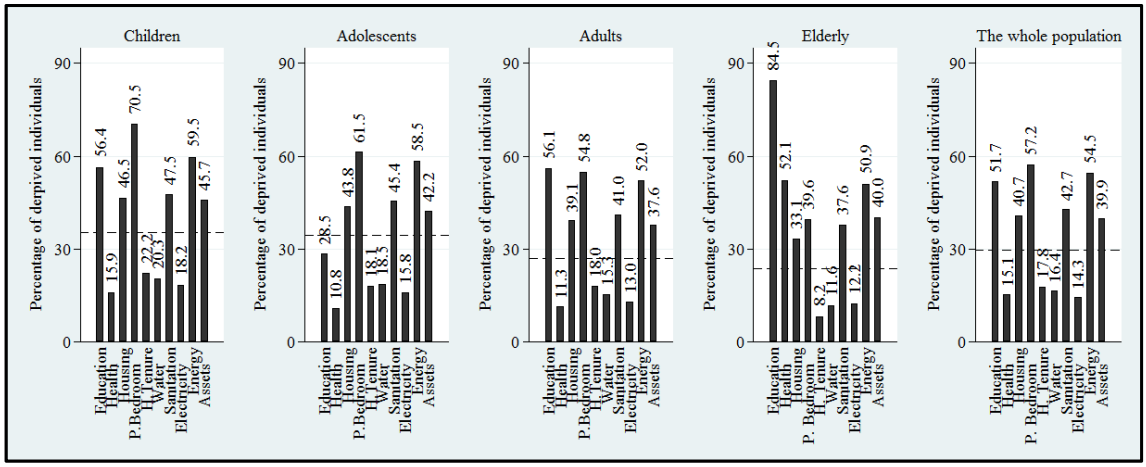

Figure 3.1: Percentage of people deprived in each indicator.
Source: Authors' estimates based on data from 2014-EMNV.
Note: The dash line represents the proportion of monetary poor individuals estimated by using the official "Overall Poverty Line" (OPL) (INIDE, 2015, p. 8), which is equivalent to 1.80 dollars a day at the official average market exchange rate for 2014.

The elderly is the most deprived group in this dimension, but children and adults also exhibit quite high deprivation rates when compared, for instance, with monetary poverty. According to our results, more than eight out of ten elderly have not completed the lower secondary school in Nicaragua, but also seven of the eight have not even finished primary school, which reflects a long-standing structural problem and evidences the failure, over decades, of the education policy to achieve that basic level, considering that primary school has been compulsory in Nicaragua since 1893 (CIASES, 2016). In turn, almost six in ten Nicaraguan adults have not attained the lower secondary school, which might, among other things, greatly lessen their chance of accessing a decent job and being integrated into society (Santos & Villatoro, 2018). Likewise, despite the existence of a national policy of early childhood education and care in Nicaragua, roughly six out of ten children are still not being exposed to a learning environment and the head of the household where they live has not achieved the lower secondary school, which means that they also run the risk of not

completing, at least, that education level. Perhaps the good news on education is the fact that adolescents have a relatively low deprivation rate (28.5%): seven out of ten adolescents are on track to achieve the lower secondary school level by 17 years of age. Considering the whole population, the results indicate that roughly one in two Nicaraguans is education deprived, evidencing the necessity of a deep reform of the education policy in Nicaragua.

Figure 3.1 also shows that among children, adolescents, and adults, the health functioning indicator exhibits the lowest deprivation rate (below 17%); but, conversely, this indicator displays the second highest deprivation rate among the elderly, five out of ten elderly people claimed to suffer from a chronic disease or several diseases, which is not surprising and is consistent with the empirical evidence from Latin America and the Caribbean (see, e.g., Gasparini et al., 2010).[74]

Regarding the living standard indicators, the results show that all age groups face substantial deprivation in housing, people-per-bedroom, sanitation, energy, and assets when compared with the monetary poverty level; for these indicators, the deprivation rates are estimated to be over 33%. In contrast, the age groups are relatively better off in housing tenure, water, and electricity indicators, for which the estimated deprivation rates are below 23%. Overall, the elderly seem to be better off group in the living standard dimension while the reverse seems to be the case for children.

Tables 3.4 and 3.5 provide the estimates of the proportion (h) of males and females deprived in each indicator, as well as the differences between females and males' estimates, in absolute and relative terms.

It can be seen in Table 3.4 that there is no substantial gender gap in education among children and elderly; males and females in both groups are almost equally likely to be deprived in education. The opposite is observed among adolescents, who show the highest gender gap in education (20%), and among adults (11%); but, interestingly, women seem to be better off in education than men. The overall gender difference in education is estimated to be 8%, in relative terms, and it is in favor of women (see Table 3.5). It can also be noted from

[74] According to Gasparini et al. (2010), in Latin America and the Caribbean region, the probability of being ill, as self-reported in the surveys, is substantially larger for elderly people than for other age groups, and the differences are especially large in Bolivia and Nicaragua. However, considering ours estimate and the one provided by those authors, which is based on data from 2001-EMNV, the prevalence of diseases among Nicaraguans aged 60 years or older seems to have decreased during the first fifteen years of the XXI century.

Table 3.4 that there are, in relative terms, sizable gender differences in health, mainly among adolescents (39%), among adults (65%), who exhibit the largest gap, and among elderly (28%); here, unlike what occurs with education, women are much worse off than men, except for the case of children. Consequently, the estimated overall gap in health functioning indicator (38%) is not in favor of women (see Table 3.5). This is a very common finding that is often considered as a paradox (Arber & Cooper, 1999; Case & Paxson, 2005), women report to suffer more from illnesses although they live longer (see, e.g., Case & Deaton, 2003, 2005a, 2005b; Nathanson, 1975), and it is "close to universal around the world" (Case & Deaton, 2005a, p. 186). Notwithstanding this paradox, the gender differences observed "are picking up a real differential in perceived health" (Case & Deaton, 2003, p. 39).

Table 3.4: Proportion (h) of males and females deprived in various indicators and gender differences.
Source: Authors' estimates based on 2014-EMNV.

Children						
	Male		Female		Difference between females and males' estimate	
Indicator	h (%)	Bootstrap SE	h (%)	Bootstrap SE	Absolute	Relative
Education	56.8	1.14	56.0	1.24	-0.84***	0.99
Health	16.7	0.90	15.1	0.89	-1.64***	0.90
Housing	47.0	0.91	46.1	1.11	-0.93***	0.98
P. Bedroom	69.6	1.06	71.4	0.92	1.79***	1.03
H. Tenure	24.4	1.16	20.0	0.96	-4.40***	0.82
Water	20.0	1.04	20.7	0.82	0.73***	1.04
Sanitation	46.5	1.04	48.5	1.02	1.98***	1.04
Electricity	17.3	0.99	19.0	0.83	1.72***	1.10
Energy	60.3	0.54	58.8	0.67	-1.50***	0.98
Assets	45.4	0.94	45.9	1.02	0.48***	1.01
Adolescents						
	Male		Female		Difference between females and males' estimate	
Indicator	h (%)	Bootstrap SE	h (%)	Bootstrap SE	Absolute	Relative
Education	31.6	0.89	25.2	0.89	-6.42***	0.80
Health	9.1	0.54	12.6	0.75	3.55***	1.39
Housing	45.4	0.78	42.1	0.82	-3.29***	0.93
P. Bedroom	62.5	0.91	60.4	0.87	-2.12***	0.97
H. Tenure	18.5	0.80	17.7	0.72	-0.77***	0.96
Water	19.9	0.76	17.0	0.72	-2.86***	0.86
Sanitation	46.6	0.86	44.2	0.89	-2.37***	0.95
Electricity	15.9	0.63	15.9	0.66	0.01**	1.00
Energy	59.1	0.45	58.0	0.47	-1.09***	0.98
Assets	41.9	0.77	42.5	0.73	0.63***	1.02

Notes: Survey weights used; standard errors (SE) were estimated following the bootstrap estimate of the standard error proposed by Efron (1981, pgs. 139-143), with 1,000 stratified bootstrap replications. *Significance levels:* * $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$.

Table 3.4-(*continued*)

Adults						
	Male		Female		Difference between females and males' estimate	
Indicator	h (%)	Bootstrap SE	h (%)	Bootstrap SE	Absolute	Relative
Education	59.4	0.61	53.1	0.63	-6.28***	0.89
Health	8.4	0.36	13.8	0.46	5.43***	1.65
Housing	40.0	0.59	38.2	0.58	-1.82***	0.95
P. Bedroom	55.5	0.68	54.1	0.61	-1.38***	0.98
H. Tenure	18.7	0.60	17.5	0.55	-1.14***	0.94
Water	16.0	0.56	14.7	0.48	-1.29***	0.92
Sanitation	43.0	0.63	39.3	0.60	-3.78***	0.91
Electricity	13.5	0.47	12.6	0.43	-0.91***	0.93
Energy	53.7	0.39	50.5	0.37	-3.20***	0.94
Assets	38.8	0.57	36.5	0.55	-2.29***	0.94
Elderly						
	Male		Female		Difference between females and males' estimate	
Indicator	h (%)	Bootstrap SE	h (%)	Bootstrap SE	Absolute	Relative
Education	83.7	0.65	85.2	0.75	1.55***	1.02
Health	45.4	1.61	58.2	1.29	12.75***	1.28
Housing	37.4	1.37	29.1	0.94	-8.27***	0.78
P. Bedroom	42.5	1.58	36.9	1.02	-5.55***	0.87
H. Tenure	9.4	1.00	7.1	0.61	-2.33***	0.75
Water	14.0	1.17	9.4	0.74	-4.56***	0.67
Sanitation	41.1	1.63	34.5	0.93	-6.63***	0.84
Electricity	15.7	1.31	9.0	0.84	-6.73***	0.57
Energy	57.9	0.55	44.4	0.64	-13.41***	0.77
Assets	44.2	1.24	36.0	0.89	-8.25***	0.81

Notes: Survey weights used; standard errors (SE) were estimated following the bootstrap estimate of the standard error proposed by Efron (1981, pgs. 139-143), with 1,000 stratified bootstrap replications. *Significance levels:* * $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$.

Table 3.5: Proportion (h) of males and females deprived in various indicators and gender differences.
Source: Authors' estimates based on 2014-EMNV.

The Whole Population						
	Male		Female		Difference between females and males' estimates	
Indicator	h (%)	Bootstrap SE	h (%)	Bootstrap SE	Absolute	Relative
Education	53.8	0.54	49.6	0.54	-4.23***	0.92
Health	12.6	0.38	17.3	0.40	4.73***	1.38
Housing	42.1	0.45	39.4	0.43	-3.63***	0.93
P. Bedroom	58.1	0.50	56.3	0.48	-2.74***	0.97
H. Tenure	18.6	0.43	17.0	0.40	-2.44***	0.91
Water	17.3	0.41	15.5	0.38	-2.55***	0.90
Sanitation	44.3	0.50	41.2	0.45	-3.96***	0.93
Electricity	14.7	0.37	13.8	0.34	-1.62***	0.94
Energy	56.3	0.27	52.8	0.26	-3.96***	0.94
Assets	40.9	0.44	39.0	0.40	-1.88***	0.95

Notes: Survey weights used; standard errors (SE) were estimated following the bootstrap estimate of the standard error proposed by Efron (1981, pgs. 139-143), with 1,000 stratified bootstrap replications. *Significance levels:* * $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$.

The results of Table 3.4 also show that, overall, women are likely to be better off in living standard indicators than men (some exceptions are female children in people-per-bedroom, water, sanitation, electricity, and assets, and female adolescents in assets); although, in most cases, the gender differences are estimated to be smaller than 10%, in relative terms, excepting for housing tenure, for children, water, for adolescents, and in the elderly's indicators, in which cases the gaps are estimated to be larger than 12%. Considering the whole population (see Table 3.5), the results indicate that the gender differentials in the living standard indicators are not higher than 10%, and men are more likely to be deprived in living standard than women. It might be argued that in some of these indicators the size and the direction of the gender gaps observed could be biased since, due to data limitations, we have not been able to make a distinction between males and females as far as deprivation within the households is concerned. However, to the extent that the indicators are non-rival and non-excludable, they benefit everyone, and it makes no sense to further investigate who benefits more.[75]

3.3.2. The incidence and the intensity of multidimensional poverty

Using a poverty cutoff of 33.33%, Table 3.6 displays the estimates of the multidimensional headcount ratio (H), the average deprivation share across the multi-dimensionally poor (A), the estimates of the adjusted headcount ratio (M_0), as well as the calculation of the corresponding gender differences, in absolute and relative terms; it also provides standard errors for each of the point estimates, using the bootstrap technique and following Bradley Efron's work on nonparametric standard errors (Efron, 1981). The first two measures account for the incidence and the intensity of multidimensional poverty, respectively, and the latter one is the measure used to compute the individual-based multidimensional poverty index (MPI index).

[75] It must, nevertheless, be recognized that there is empirical evidence suggesting that deprivations in some living standard indicators impact females more than males (Vijaya, et al., 2014). For instance, the lack of a drinking water source in or near home increases the work burden of women and contributes to their time poverty, as they are "the primary suppliers of water to household around the globe" (Sorenson, et al., 2011, p. 1526). The use of unclean cooking fuels (indoor air pollution) affects particularly the health of women, as they are the primary cook in the household (Duflo et al., 2008a, 2008b, 2016), it also contributes to women's poverty time (Clancy, Ummar, Shakya, & Kelkar, 2007). Likewise, there is evidence of substantial gender differences in the ownership of consumer durables, especially transport vehicles, in favor of men (Deere, Alvarado, & Twyman, 2012). However, in the absence of a time use module or of individual-data on asset ownership, it is impossible to identify which female in the household is most deprived (Vijaya, et al., 2014), and there is not much more that can be done.

Table 3.6: Multi-dimensional poverty measures by age group and gender, and gender differences.
Source: Authors' estimates based on data from 2014-EMNV.

The multidimensional headcount ratio (H): the incidence of multidimensional poverty						
	Male		Female		Difference between females and males' estimate	
Subgroup	H (%)	Bootstrap SE	H (%)	Bootstrap SE	Absolute	Relative
Children	63.9	1.09	62.7	1.16	-1.27***	0.98
Adolescents	38.2	0.94	34.9	0.98	-3.30***	0.91
Adults	62.7	0.63	58.5	0.64	-4.21***	0.93
Elderly	91.6	0.52	94.1	0.58	2.47***	1.03
The whole population	58.9	0.55	56.5	0.51	-2.41***	0.96
The average deprivation share among the poor (A): the intensity of multidimensional poverty						
	Male		Female		Difference between females and males' estimate	
Subgroup	A	Bootstrap SE	A	Bootstrap SE	Absolute	Relative
Children	0.5415	0.0043	0.5394	0.0045	-0.0020***	1.00
Adolescents	0.5218	0.0029	0.5200	0.0037	-0.0018***	1.00
Adults	0.5044	0.0020	0.5211	0.0025	0.0167***	1.03
Elderly	0.5862	0.0065	0.5983	0.0044	0.0121***	1.02
The whole population	0.5227	0.0020	0.5339	0.0020	0.0113***	1.02
The adjusted multidimensional headcount ratio (M_0): MPI index (H x A)						
	Male		Female		Difference between females and males' estimate	
Subgroup	M_0	Bootstrap SE	M_0	Bootstrap SE	Absolute	Relative
Children	0.3463	0.0069	0.3378	0.0069	-0.0085***	0.98
Adolescents	0.1995	0.0054	0.1817	0.0054	-0.0179***	0.91
Adults	0.3167	0.0034	0.3051	0.0036	-0.0116***	0.96
Elderly	0.5370	0.0062	0.5631	0.0055	0.0261***	1.05
The whole population	0.3079	0.0025	0.3015	0.0025	-0.0064***	0.98

Notes: Survey weights used; standard errors (SE) were estimated following the bootstrap estimate of the standard error proposed by Efron (1981, pgs. 139-143), with 1,000 stratified bootstrap replications. *Significance levels:* * $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$.

We find that in Nicaragua, there are statistically significant gender gaps in poverty (incidence, intensity, and MPI index), but, in relative terms, these are estimated to be lower than 10% across the age groups, so they do not seem to be substantial in size when compared, for instance, to recent findings in other contexts. For instance, Rogan (2016a) found that in South Africa, the size of the gender differentials is 29% (excluding the gap in poverty intensity); Klasen and Lahoti (2016) found that in India, the size is higher than 30% (except for intensity). In Nicaragua, the highest gender gap in poverty incidence and in the MPI index is found among adolescents (9%) and the lowest one among children (2%); the gender differences observed among children, adolescents, and adults are in favor of females, but the reverse is the case among elderly: elderly women seem to be slightly worse off (5%) than men. It can also be seen in Table 3.6 that in Nicaragua, overall, both females and males are likely to suffer from the same intensity of multidimensional poverty; we can accordingly conclude that the size and the direction of the estimated gender gaps in MPI index are mostly driven by the difference observed in the incidence of poverty. Considering the whole

population, the estimates suggest that in Nicaragua, the gender gaps in multidimensional poverty are lower than 5%, and poverty does not seem to be feminized: Nicaraguan women seem to be slightly better off in poverty incidence (4%)[76] and MPI index (2%) than men, although the reverse seems to be the case for poverty intensity (2%).[77]

In order to discover what is exactly driving the observed gender gaps in poverty incidence, we also estimate the absolute contribution of the gender difference in each of the ten indicators to the overall estimated gender gaps. To do this, we first compute for each gender a "weighted" censored headcount ratio for each indicator, which in each case is calculated by dividing the contribution of each indicator to the estimated MPI index by the corresponding poverty intensity. Then, we estimate the rate differences, which are the absolute contributions to the overall gender gaps observed in Table 3.6. Figure 3.2 shows such contributions in the form of a bar graph for each indicator and for each group, and for the whole population. In this figure, a positive bar in any indicator means that females are worse off than males in that indicator, and vice versa. The last bar in each graph represents the size of the overall gap, which is computed adding up all the indicator gaps, and it is the one that appears in the second-to-last column of Table 3.6.

[76] The estimated overall multidimensional poverty incidence rate reveals that in Nicaragua roughly six in ten individuals (or 3.6 million people) are multi-dimensionally poor; such a rate is, approximately, 27 percentage points higher than the monetary poverty one (see Table 3.A.5 in Appendix 3.A). As a reference, the MPI-LA, based on 2009-EMNV survey and using the household as the unit of analysis, shows that the multidimensional poverty incidence in Nicaragua exceeds 70% and is the highest in Latin America (Santos & Villatoro, 2018). Therefore, the incidence of multidimensional poverty in Nicaragua still remains a huge problem, and the monetary approach seems to be unable to reflect the extent of it.

[77] The multidimensional poverty intensity ranges from 50.4% (male adults) to 59.8% (female elderly), and the overall intensity is estimated to be larger than 52.0%. That is, the multi-dimensionally poor in Nicaragua are, on average, simultaneously deprived in more than five out of the ten indicators considered, which means that the intensity in Nicaragua is large (by definition, the minimum intensity value is the poverty cut-off: k = 33.3%). This finding is in line with the regional and national evidence. For instance, Santos & Villatoro (2018) found that the multidimensional poverty intensity in Latin America surpasses 45% in countries with the largest poverty incidence rates, such as Nicaragua; Espinoza-Delgado and López-Laborda (2017) also found that multidimensional poverty intensity in Nicaragua is larger than 40%.

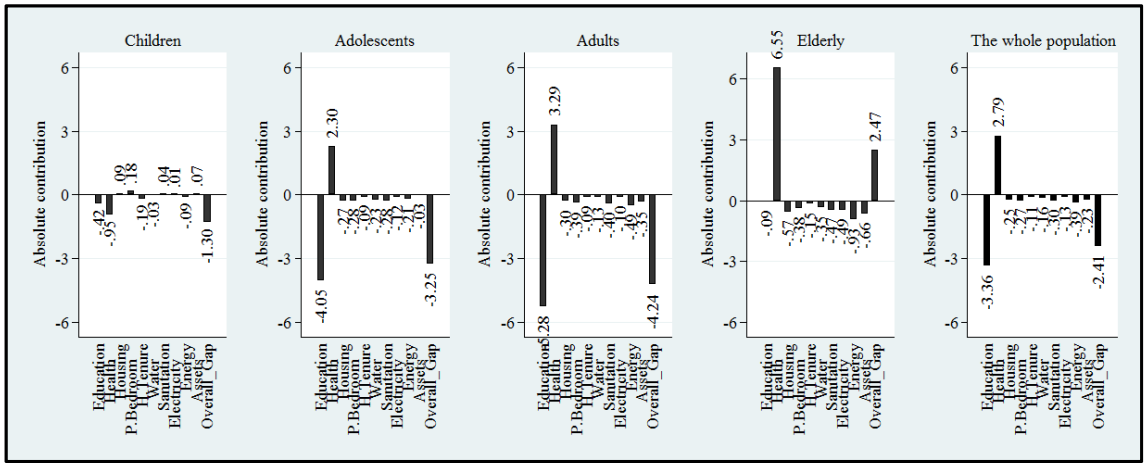

Figure 3.2: Absolute contribution of the gender gap in each indicator to the overall gap.
Source: Authors' estimates based on 2014-EMNV.
Note: A positive bar in any indicator means that females are worse off than males in that indicator, and vice versa. The Overall_Gap is obtained adding up all indicator gaps.

Figure 3.2 makes it clear that among children, the gender gap in multidimensional poverty incidence that favors females is mostly driven by the difference in health, followed by the one in education. For its part, among adolescents and among adults, the overall gender gap that also favors females is mainly explained by the differential in education, which is in turn reinforced by the gaps in the living standard indicators. Among the elderly, the estimated gap that is in favor of men is clearly driven by the differential in health; it should be noted that in this case, unlike what occurs with the other three groups, the gap in each of the living standard indicators is larger than the gap in education. Finally, the overall gender gap, considering the whole population, is explained by the gap in education and the cumulative gaps in the living standard dimension, while the gap in health that hurts women operates in the opposite direction. It is worthy of note that similar patterns would be found if we estimated the absolute contributions to the overall gender gaps discovered in MPI index since this measure only differs from H (the incidence) in that it takes A (the intensity) into account.

As it was discussed earlier in this essay, the MPI index (M_0 measure) is not sensitive to inequality among the multi-dimensionally poor; therefore, we also estimate the Correlation Sensitive Poverty Index (CSPI) proposed by Rippin (2013) that takes inequality into account. The CSPI adopts the union approach to solve the problem of identification of the poor, so the resulting headcount ratios might be "too high to be useful" (Rippin, 2017, p. 55), as any individual deprived in at least one indicator is considered to be multi-dimensionally poor, but these are helpful for qualitative comparison purposes with the previous findings. The results are shown in Table 3.7.

Table 3.7: Multi-dimensional poverty measures using the union approach by age group and gender, and gender differences.
Source: Authors' estimates based on data from EMNV-2014.

The multidimensional headcount ratio (H): the incidence of multidimensional poverty						
	Male		Female		Difference between females and males' estimate	
Subgroup	H (%)	Bootstrap SE	H (%)	Bootstrap SE	Absolute	Relative
Children	93.4	0.36	90.9	0.45	-2.47***	0.97
Adolescents	88.2	0.38	86.4	0.40	-1.88***	0.98
Adults	86.6	0.33	85.3	0.32	-1.31***	0.98
Elderly	94.6	0.43	95.9	0.54	1.24***	1.01
The whole population	88.6	0.24	87.2	0.24	-1.33***	0.99
The aggregate deprivation count ratio: the intensity of multidimensional poverty						
	Male		Female		Difference between females and males' estimate	
Subgroup	Intensity	Bootstrap SE	Intensity	Bootstrap SE	Absolute	Relative
Children	0.4100	0.0058	0.4081	0.0055	-0.0018***	1.00
Adolescents	0.3001	0.0044	0.2899	0.0045	-0.0102***	0.97
Adults	0.3955	0.0028	0.3902	0.0031	-0.0053***	0.99
Elderly	0.5706	0.0063	0.5884	0.0048	0.0178***	1.03
The whole population	0.3878	0.0026	0.3874	0.0027	-0.0004***	1.00
The correlation sensitive poverty index (CSPI)						
	Male		Female		Difference between females and males' estimate	
Subgroup	CSPI	Bootstrap SE	CSPI	Bootstrap SE	Absolute	Relative
Children	0.2099	0.0053	0.2019	0.0026	-0.0081***	0.96
Adolescents	0.1218	0.0051	0.1126	0.0080	-0.0092***	0.92
Adults	0.1732	0.0032	0.1748	0.0062	0.0016***	1.01
Elderly	0.3482	0.0079	0.3706	0.0060	0.0225***	1.06
The whole population	0.1786	0.0016	0.1798	0.0018	0.0012***	1.01

Notes: Survey weights used; standard errors (SE) were estimated following the bootstrap estimate of the standard error proposed by Efron (1981, pgs. 139-143), with 1,000 stratified bootstrap replications. *Significance levels:* * $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$.

It can be seen in Table 3.7 that the multidimensional poverty incidence under the union approach is in all cases above 85%, as could be expected. Now, little variability in poverty incidence across the groups is observed, but the reverse is the case for the intensity. Interestingly, the variability noted in the CSPI index is quite similar to the one in MPI index; the elderly turn out, again, to be the most vulnerable group in terms of multidimensional poverty (incidence, intensity, and CSPI index). Regarding the gender gaps, although statistically significant, they do not seem to be substantial in size. Overall, girls and women seem to be a little bit better off than boys and men; some exceptions are female elderly, who are slightly worse off than their male counterparts, and adult women in the case of CSPI index. Considering the population as a whole, the estimates indicate that in Nicaragua, the

gender gaps in multidimensional poverty are lower than 2%, and poverty does not seem to be feminized: women and men are almost equally likely to be multi-dimensionally poor. Therefore, with very few exceptions, the same conclusions that were drawn from the MPI analysis can be drawn from Table 3.7.

3.3.3. Inequality among the multi-dimensionally poor

Inequality, one of the three "dimensions of poverty" (Jenkins & Lambert, 1997, p. 317), has been ignored by the vast majority of empirical contributions focusing on multidimensional poverty analysis; accordingly, we also contribute to close this gap in the literature by providing insights about absolute inequality in deprivation scores among the multi-dimensionally poor in Nicaragua, using the measure proposed by Alkire and Seth (2014a), which is described in Section 3.2.2 of this essay. The estimates are provided in Table 3.8.

Table 3.8: Inequality among the multi-dimensionally poor (Iq) by age group and gender, and gender differences.
Sources: Authors' estimates based on data from EMNV-2014.

	Male		Female		Difference between females and males' estimate	
Subgroup	Iq	Bootstrap SE	Iq	Bootstrap SE	Absolute	Relative
Children	0.1015	0.0051	0.0854	0.0056	-0.0162***	0.84
Adolescents	0.0671	0.0037	0.0714	0.0052	0.0043***	1.06
Adults	0.0615	0.0024	0.0802	0.0030	0.0187***	1.30
Elderly	0.1416	0.0053	0.1443	0.0038	0.0027***	1.02
The whole population	0.0811	0.0025	0.0911	0.0023	0.0100***	1.12

Notes: Survey weights used; standard errors (SE) were estimated following the bootstrap estimate of the standard error proposed by Efron (1981, pgs. 139-143), with 1,000 stratified bootstrap replications. *Significance levels:* * $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$.

As a whole, the results from Table 3.8 suggest that in Nicaragua, there is a U-shaped relationship between the inequality level and the age of the individual, which is in line with the international evidence that shows that there is a positive relationship between the Multi-dimensional Poverty Index value and inequality among the poor (see, e.g., Alkire & Seth, 2014b). According to our results, the largest inequality in deprivation scores is found among the elderly women; conversely, the smallest one is found among the adult men.

Concerning gender differences, Table 3.8 also reveals interesting findings. Firstly, it can be noted that both among children and among adults, the gender gap in inequality is, in relative terms, substantially larger than the gender difference observed in multidimensional poverty (16% vs 2%, and 30% vs 4%, respectively). Secondly, excluding the case of children,

inequality among multi-dimensionally poor females seems to be higher than the one estimated among multi-dimensionally poor males. It is worthy of note that the direction of the observed gender gap both among adolescents and among adults now benefits males; that is, inequality among the multi-dimensionally poor people of these age groups seems to be feminized. Finally, as a result of the previous finding, Table 3.8 displays that the overall gender gap in inequality that is estimated to be 12%, in relative terms, is in favor of males and is mostly driven by the estimated gap among adults. Therefore, in Nicaragua, unlike what is observed for the case of the incidence of multidimensional poverty, inequality seems to be feminized: the multi-dimensionally poor women are living in very intense poverty when compared to the multi-dimensionally poor men.

In order to better understanding the source of the estimated inequality levels and the gender gaps, Figure 3.3 depicts the distribution of intensities for poor males and in poor females. Since the absolute inequality measure employed in this essay is sensitive to pockets of individuals who have large deprivation scores (Alkire & Seth, 2014b), the inequality is greater among the poor group that exhibits a larger share of people with this feature in their distribution.

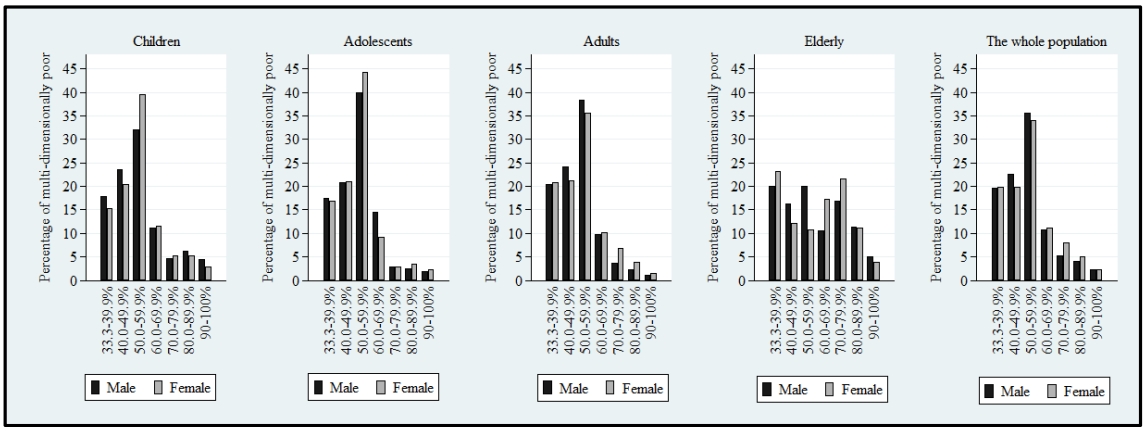

Figure 3.3: Distributions of intensities in poor males and in poor females, by Group.
Source: Authors' estimates based on 2014-EMNV.

It can be noted in Figure 3.3 that the elderly exhibit a markedly different distribution of intensities. More than 30% of the multi-dimensionally poor elderly are deprived in 70% or more of the weighted indicators; instead, less than 15.5% of the multi-dimensionally poor belonging to the other age groups suffer such intensity. This is the main reason why the largest inequality level is found among the elderly (elderly women). On the other hand, the direction of the observed gender gap among children that favors females is explained by the

fact that the share of multi-dimensionally poor children who are deprived in 70% or more of the weighted indicators is larger among males than among females (15.3% vs 13.1%). The reverse is the case for adults (7.2% vs 12.3%), who exhibit the greatest gender gap in inequality. Finally, the direction of the overall estimated gender difference that favors men is due to the fact that the proportion of multi-dimensionally poor individuals facing deprivation in 70% or more of the weighted indicators is greater among women than among men (15.2% vs 11.6%). Therefore, considering these findings, we can conclude that even though the gender gap in multidimensional poverty is relatively small, the gender difference in inequality can be substantially larger given that females (or males) have a pocket of multi-dimensionally poor people that are suffering from very intense poverty while their male (female) counterparts do not; the bigger the size of that pocket, the larger the gender gap.

3.3.4. Gender gaps in poverty using an enhanced multidimensional poverty measure for adults and elderly

The estimates of the enhanced multidimensional poverty measure that considers employment (for adults) and social protection (for elderly) as a fourth dimension are shown in Tables 3.9 and 3.10, respectively. We have attached equal weight to each dimension (25%) and set the second cut-off at 25%, which means that it is qualitatively the same as the one used earlier (33.33%): individuals are considered to be multi-dimensionally poor if they are deprived in at least one full dimension, so that the new findings are comparable with the previous ones.

Table 3.9: Multi-dimensional poverty measures among adults, considering employment as fourth dimension, and gender differences.
Source: Authors' estimates based on data from EMNV-2014.

Measure	Male	Bootstrap SE	Female	Bootstrap SE	Difference between females and males' estimate	
					Absolute	Relative
Incidence	69.7	0.57	74.4	0.50	4.74***	1.07
Intensity	0.4031	0.0021	0.4787	0.0026	0.0756***	1.19
MPI index	0.2810	0.0026	0.3561	0.0031	0.0751***	1.27
Inequality	0.0617	0.0019	0.1262	0.0024	0.0644***	2.04

Notes: Survey weights used; standard errors (SE) were estimated following the bootstrap estimate of the standard error proposed by Efron (1981, pgs. 139-143), with 1,000 stratified bootstrap replications. *Significance levels:* * $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$.

Table 3.10: Multi-dimensional poverty measures among elderly, considering social protection as fourth dimension, and gender differences.
Source: Authors' estimates based on data from EMNV-2014.

Measure	Male	Bootstrap SE	Female	Bootstrap SE	Difference between females and males' estimate	
					Absolute	Relative
Incidence	92.1	0.49	95.3	0.55	3.15***	1.03
Intensity	0.4894	0.0061	0.5435	0.0047	0.0540***	1.11
MPI index	0.4508	0.0061	0.5181	0.0053	0.0672***	1.15
Inequality	0.1426	0.0082	0.1685	0.0052	0.0259***	1.18

Notes: Survey weights used; standard errors (SE) were estimated following the bootstrap estimate of the standard error proposed by Efron (1981, pgs. 139-143), with 1,000 stratified bootstrap replications. *Significance levels:* * $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$.

As a whole, Tables 3.9 and 3.10 make it clear that the incorporation of dimensions under which women have relatively larger deprivation into a multidimensional poverty measure lead to sizeable gender gaps. The results show that when information on employment, domestic work, and social protection is added to the three-dimensional index (education, health, and living standard), the gender gaps rise, and multidimensional poverty becomes clearly feminized: women are more likely to be multi-dimensionally poor than men.

3.3.5. Shedding some light on the determinants of monetary and multidimensional poverty

As a complement to the previous analysis, we explore the determinants of the monetary and multidimensional poverty in Nicaragua by estimating logit regression models in which the endogenous variable is equal to 1 if the individual is (monetarily or multi-dimensionally) poor, to 0 otherwise. Specifically, in Model 1 (M1), the dependent variable is the probability that an individual is considered to be monetarily poor, using the official poverty definition to determine who is or is not poor, and, in Model 2 (M2) and Model 3 (M3), it is the probability of being identified as multi-dimensionally poor, according to the three-dimensional measure (M2) and the four-dimensional one (M3), respectively. In each logit regression, the following exogenous variables are taken into account: the gender of the individual (male-female), the age and its square, the area of residence (urban-rural), the region of residence (three dummy variables: Pacific, Central, and Atlantic), the size of the household and its square, the gender of the household head and their marital status (four dummy variables: married, unmarried, divorced, and widower), and some interaction terms between the gender and the marital status of the household head, as well as between the area and the region of residence. The results of the three models are shown in Table 3.11.

Table 3.11: Results of the logit regressions.
Source: Authors' estimates based on 2014-EMNV.

Poverty	M1		M2		M3	
Explanatory variables	Coef.	Robust SE	Coef.	Robust SE	Coef.	Robust SE
Gender (base: male)						
Female	-0.02104	0.04589	-0.13646***	0.03741	0.34895***	0.04741
Age	-0.01260**	0.00364	-0.02121***	0.00415	-0.02925*	0.01206
Square of Age	0.00013*	0.00005	0.00106***	0.00007	0.00087***	0.00015
Area of Residence (base: urban)						
Rural	0.79613***	0.10677	0.61329***	0.09229	0.49699***	0.12350
Region of Residence (base: the capital, Managua)						
Pacific	0.14247*	0.06686	0.18705***	0.04722	0.16375**	0.05779
Central	0.84686***	0.06469	0.29782***	0.04688	0.24381***	0.05735
Atlantic	0.60742***	0.06968	0.31779***	0.05355	0.24393***	0.06920
Household size	0.75938***	0.03061	0.12975***	0.02215	0.13132***	0.02851
Square of the household size	-0.03180***	0.00182	-0.00498***	0.00143	-0.00557**	0.00199
Gender of the Household Head (base: female)						
Male	3.17592***	0.50734	1.28017***	0.32907	0.99026*	0.40683
Marital Status of the Household Head (base: single)						
Married	2.75174***	0.39117	0.77535**	0.25085	0.94917**	0.30152
Unmarried	3.04974***	0.37789	1.29285***	0.24339	1.23299***	0.29455
Divorced	2.84163***	0.37203	1.15441***	0.23811	0.94956**	0.28720
Widowed	2.57362***	0.37695	1.10266***	0.24215	0.93514**	0.29126
Interaction: married (male-headed household)	-3.31831***	0.52624	-1.13640**	0.34276	-1.01594*	0.42226
Interaction: unmarried (male-headed household)	-3.18562***	0.51686	-1.25835***	0.33779	-0.88602*	0.41930
Interaction: divorced (male-headed household)	-3.59774***	0.53874	-1.04854**	0.35585	-0.69611	0.43188
Interaction: widowed (male-headed household)	-2.85718***	0.55390	-1.11215**	0.37675	-0.49076	0.44835
Interaction rural (Pacific)	0.50926***	0.13344	0.17892	0.11456	0.60512***	0.16725
Interaction: rural (Central)	0.61077***	0.13303	0.97421***	0.12148	1.57465***	0.19950
Interaction: rural (Atlantic)	1.06708***	0.12874	0.52699***	0.11689	1.20103***	0.17684
Constant	-7.86459***	0.39287	-2.38305***	0.25135	-1.52136***	0.36540
Number of obs.	29381		29381		18723	
Wald chi2(21)	2818.06		2263.49		1226.38	
Prob. > chi2	0.00000		0.00000		0.00000	
Pseudo R2	0.2396		0.1584		0.1519	
Log pseudolikelihood	-2881854.40		-3579153.90		-1869089.80	

Notes: Survey weights used; robust standard errors (SE) are reported; outcome: dummy equal to 1 if individual is considered to be (monetarily, M1, or multi-dimensionally, M2, M3) poor. *Significance levels:* * $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$.

As it can be seen in Table 3.11, M1 suggests that the gender variable is statistically non-significant, which means that overall the sex of an individual as such has nothing to do with the probability of being monetarily poor. However, both M2 and M3 show that gender does matter when a multidimensional definition of poverty is adopted, although the direction of the gender bias depends on the information considered in the analysis. The difference in the statistical significance of the gender variable observed between the two ways of defining

poverty (monetary and multidimensional) might be explained by the fact that the multidimensional approach followed in this essay is able to capture some of the intra-household inequalities that the monetary approach is incapable of doing; that is, one might suppose that it is an intra-household inequality issue. Using the three-dimensional measure (health, education, and living standard), the results (M2) show that in Nicaragua, males have a higher probability of being multi-dimensionally poor than females, but the opposite is true when the multidimensional poverty measure is enhanced with information on employment and social security (M3). Observe that in M3, gender even has a much stronger effect on the probability of being multi-dimensionally poor than in M2, which confirms our descriptive findings.

The results from M1, M2, and M3 indicate that regardless of the approach used to identify the poor, there is, *ceteris paribus*, a U-shaped relationship between the age of the individual and the probability that he/she will be considered as poor. This finding is consistent with our main findings, but it is inconsistent with the conclusions that might be drawn from the official estimates (monetary approach) as these suggest that the lowest poverty rates are found among adults and elderly (see Table 3.A.5 in Appendix 3.A). There seems also to be a U-shaped relationship between the size of the household to which the individual belongs and the probability that he/she will be deemed poor.

The results also make it clear that, *ceteris paribus*, individuals from rural areas certainly have a higher probability of being poor, mainly monetarily poor, than those from urban areas, a finding that has been emphasized by the regional and global empirical evidence as well (see, e.g., Alkire & Santos, 2014; Battiston, Cruces, López-Calva, Lugo, & Santos, 2013; ECLAC, 2013; Santos & Villatoro, 2018), and that warrants special attention from policy-makers. The probability of being considered as poor seems also to be much larger among individuals living outside the capital, Managua, and it is the highest for individuals living in the Central and Atlantic rural areas, as also observed by Altamirano and Teixeira (2017).

As far as the gender of the household head and their marital status are concerned, as well as the corresponding interaction terms that capture the joint impact of these variables on the probability the individual to be considered as poor, assuming that the signs of the coefficients of the interaction terms are correct, the three models suggest that they have a strong impact on the probability of being poor. However, such an impact varies between the

poverty approaches analyzed, and it is much more sizable when the monetary approach is adopted (M1). Although, in general, especially among policy-makers and international agency discourse, there is a belief that female-headed households are more likely to be poor than male-headed households and, as a result, females are likely to be poorer than males (Bradshaw et al., 2017b, 2018; Chant, 2008; Klasen et al., 2015), the results of Table 3.11 reveal that such an assertion does not seem to be supported by the empirical evidence from Nicaragua, particularly when a multidimensional approach is followed.

Table 3.11 shows that, regardless of the approach used, individuals living in households headed by a single female or a widow seem to have, ceteris paribus, a lower probability of being considered as poor than those living in households headed by a single male or a widower. The probability of being multi-dimensionally poor is also lower in households led by divorced women as well as in those headed by unmarried women; but, the reverse occurs with the probability of being monetarily poor. It should also be noted that individuals living in married-women-headed households have a larger probability of being monetarily poor than those living in married-men-headed households; but this finding does not seem to be true with a multidimensional approach, particularly with the three-dimensional measure.

Focusing on multidimensional poverty approach (M2 and M3), our main concern in this essay, we can conclude that in Nicaragua, overall, the households headed by women are on average better off than those headed by men, which is in line with the recent empirical evidence on Latin America, in general, and on Nicaragua, in particular. For instance, Liu, Esteve, and Trevino (2017) found that in Latin America, households headed by men are more likely to be living in poorer conditions than those headed by women; Altamirano and Teixeira (2017), using a household-based multidimensional poverty measure, found that in Nicaragua, there is a poverty dominance of male-headed households over single-mother and female-headed households. However, it is worthy of mention that this finding does not imply automatically that in Nicaragua, women are less likely to be multi-dimensionally poor than men; as M3 suggests, females living in households led by women have a larger probability of being multi-dimensionally poor than their male counterparts.

3.4. Robustness analysis

The design of a multidimensional poverty measure entails the choice of diverse parameters (Alkire et al., 2015), and thus we are interested in assessing how sensitive the estimates are to this selection of parameters: are the main conclusions robust to these choices? Consequently, we examine extensively the robustness of our conclusions to i) changes in the multidimensional poverty threshold (k) and ii) in the weighting structure (w). To do this, we employ the complementary cumulative distribution function (CCDF) proposed by Alkire et al. (2015) and also compute H, A, M_0, and I_q, considering five alternative weighting structures. The results are shown in Appendix 3.B. Overall, we do not find strict first-order stochastic dominance between the CCDFs for different k values; however, limiting the values of k to a more plausible range of 20% to 40%, that is, when restricted tests of dominance are conducted (Alkire and Santos, 2014), we find that in general, the men's distributions dominate those of women, and, consequently, men's multidimensional poverty headcount ratios do not seem to be lower than women's: multi-dimensional poverty in Nicaragua does not seem to be feminized. On the other hand, we observe that the size of the gender gaps in poverty and inequality is quite sensitive to modifications in the weighting schemes, but some robust conclusions can be drawn as well. For instance, the robustness analysis suggests that the intensity and inequality among Nicaraguan females are not really lower than among males, which means that in Nicaragua both poverty dimensions seem to be feminized: females seem to be living in very intense multidimensional poverty when compared with their male counterparts.

3.5. Concluding remarks

Household-based multidimensional poverty measures, such as the global-MPI and the MPI-LA, ignore the intra-household inequalities and are gender-insensitive, as these equate the poverty condition of the household with the individuals' poverty condition in the household. Consequently, in this essay, we contributed to the literature on multidimensional poverty and gender inequality by proposing an individual-based multidimensional poverty measure for Nicaragua, which can also be applied in other similar contexts, and have estimated the gender gaps in the three I's (incidence, intensity, and inequality) of multidimensional poverty in this Central American country. Overall, the results offer strong evidence in support of a more disaggregated multidimensional poverty analysis, since

multidimensional poverty incidence and inequality can be very different for different age groups in the society.

We found that in Nicaragua, the multidimensional poverty incidence, estimated to be about 57%, still remains a huge problem, and that the monetary approach seems to be incapable of revealing the extent of it. Likewise, the multidimensional poverty intensity is a large concern in this country as well: on average, the multi-dimensionally poor people suffer from deprivation in more than 50% of the indicators considered in the analysis.

Yet, when a three-dimensional (education, health, and living standard) index is used, the multidimensional poverty in Nicaragua does not seem to be feminized: overall, males and females are almost equally likely to be multi-dimensionally poor. The gender gaps are estimated to be lower than 5%; women are slightly better off than men in terms of the poverty incidence (4%) and the MPI index (2%), while the reverse is the case for the intensity (2%). However, the inequality among the multi-dimensionally poor, an issue that has also been neglected by most of the existing empirical papers, is clearly feminized, especially among adults. We found that in Nicaragua, the gender gap in inequality is 12%, and it is in favor of men; this means that the multi-dimensionally poor women are living in very intense poverty when compared to the multi-dimensionally poor men, even though the observed poverty levels among women and among men are quite similar.

As suspected by Bradshaw et al. (2017a), we found that adding a dimension under which women face larger deprivation into the three-dimensional measure leads to greater estimates of the incidence, intensity, and inequality of women's multidimensional poverty. When a fourth dimension that considers information on employment, domestic work, and social protection, which are highly gendered (Chant, 2008; Duflo, 2012; Klasen, 2007), is included into the analysis, we have found that the gender gaps in Nicaragua are much more substantial, and poverty and inequality are, in this new context, unambiguously feminized: women are clearly more likely to be multi-dimensionally poor than men. This finding suggests that the evaluation of women's relative multidimensional poverty may depend on what is measured and what dimensions of gendered poverty are included in such assessments (Bradshaw et al., 2017a, 2018).

In order to shed some light on the determinants of multidimensional poverty in Nicaragua, we complemented the descriptive analysis by estimating logit regressions with

seven categories of explanatory variables: the gender of the individuals, their age, the individuals' area of residence, their residence region, the size of the household, the gender of the head of the household, and their marital status. We found that the gender of the individuals has a statistically significant effect on the probability of being multi-dimensionally poor, but the direction of such an effect depends on the information considered in the analysis, confirming the previous finding. Using a three-dimensional index, males have a higher probability of being multi-dimensionally poor than females, but the opposite is true when such an index is enhanced with information on employment, domestic work and social security. The regressions also suggest that both the gender of the household head and their marital status have a strong impact on the probability of being multi-dimensionally poor. Overall, in line with the recent empirical evidence on Nicaragua and Latin America (see, e.g., Altamirano & Damiano, 2017; Liu et al., 2017), we found that in Nicaragua, households headed by women are, on average, better off than those headed by men, which challenges the notion that female-headed households are worse off than those led by males in terms of poverty.

Finally, it must be recognized that due to data restrictions and the unfitness of the survey to capture gendered experiences of poverty, we only partly succeeded in individualizing the multidimensional poverty measure and in assessing gender differences in poverty and inequality in Nicaragua, and, consequently, our approach is not exempt from limitations. On one hand, the assumption that the living standard indicators are public goods is clearly unsatisfactory and might lead to underestimations of women's poverty and inequality, as the gender literature has suggested that the deprivation in some of them (particularly in water, energy, and assets) impacts women substantially more than men (Bradshaw et al., 2017a; Duflo, 2008a, 2008b, 2010; 2012; Sorenson, et al., 2011). On the other hand, although the dimensions considered in our analysis are key well-being dimensions, both for males and for females, and can also be framed into the list proposed by Robeyns (2003) for gender inequality assessment, many of the dimensions of gendered poverty that are known to exist in the literature on gender inequality, such as violence against women and girls, time poverty, and power poverty, which have mainly been explored in qualitative studies and using small-scale surveys, are missing in our analysis (see, e.g. Agarwal, 1994, 1997; Bessell, 2015; Bradshaw, 2002, 2013; Bradshaw et al., 2017a, 2017b, 2018; Brickell & Chant, 2010; Chant, 2008, 2016; Duflo, 2012; Deere et al., 2012; Pogge & Wisor, 2016; Robeyns, 2003). However, it is fair to say that in the absence of the relevant

information and more refined data (e.g., a time use module, individual data on assets ownership, or subjective information from individuals), it is impossible to identify which individual (woman) in the household is most affected (Vijaya, et al., 2014). Therefore, we also endorse the idea that more and better individual data are needed (Bradshaw et al., 2017a, 2017b, 2018; Pogge & Wisor, 2016; World Bank, 2017).

3.A. Appendix

Table 3.A.1: Relation between the proportion (%) of individuals deprived in health and assets index by age group.
Source: Authors' estimates based on 2014-EMNV

		Scores of Assets Index						
	Group	0	1	2	3	4	5	6
Deprived rate in health	Children	63.87	20.33	8.55	4.70	2.35	0.19	0.00
	Adolescents	61.02	22.94	9.49	4.26	1.75	0.54	0.00
	Adults	44.75	28.22	15.05	7.05	4.17	0.69	0.06
	Elderly	48.57	26.92	12.53	6.99	4.60	0.32	0.07

Notes: Survey weights used. A score of 0 signifies that individual does not have access to any of the following six items: microwave, motorcycle, car, refrigerator, freezer or washing machine; a score of 1 means that the individual has access to one of the six items; and so on.

Table 3.A.2: Relation between the proportion (%) of individuals deprived in health and income quintile (Q) by age group.
Source: Authors' estimates based on 2014-EMNV

Group	Poorest Q	Q 2	Q 3	Q 4	Richest Q
Children	13.43	13.79	17.44	19.32	16.84
Adolescents	10.72	10.89	9.65	11.64	11.51
Adults	7.79	9.31	10.37	14.03	13.79
Elderly	51.17	52.11	50.30	50.02	55.31
Correlation Coefficients of Spearman					
		Children	Adolescents	Adults	Elderly
Health Functioning - Income Quintile		-.140***	-.139***	.100***	.276***

Notes: Survey weights used. ***Correlation is significant at the 0.01 level (2-tailed).

Table 3.A.3: Proportion of individuals deprived in various indicators (h %) by age group.
Source: Authors' estimates based on 2014-EMNV

	Children			Adolescents		
Indicator	h	Confidence interval at 95%		h	Confidence interval at 95%	
		Lower bound	Upper bound		Lower bound	Upper bound
Education	56.4	54.7	58.0	28.5	27.2	29.8
Health	15.9	14.6	17.2	10.8	10.0	11.7
Housing	46.5	45.2	48.0	43.8	42.6	45.0
P. Bedroom	70.5	69.1	71.8	61.5	60.2	62.7
H. Tenure	22.2	20.8	23.6	18.1	17.0	19.2
Water	20.3	19.1	21.6	18.5	17.5	19.6
Sanitation	47.5	46.0	49.0	45.4	44.2	46.5
Electricity	18.2	17.0	19.4	15.8	15.0	16.7
Energy	59.5	58.6	60.3	58.5	57.9	59.2
Assets	45.7	44.3	47.0	42.2	41.1	43.2
	Adults			Elderly		
Indicator	h	Confidence interval at 95%		h	Confidence interval at 95%	
		Lower bound	Upper bound		Lower bound	Upper bound
Education	56.1	55.2	57.0	84.5	83.5	85.4
Health	11.3	10.7	11.8	52.1	50.2	53.9
Housing	39.1	38.3	39.9	33.1	31.5	34.7
P. Bedroom	54.8	53.8	55.6	39.5	37.7	41.3
H. Tenure	18.0	17.2	18.7	8.2	7.1	9.3
Water	15.3	14.5	16.0	11.6	10.3	12.9
Sanitation	41.0	40.2	41.9	37.6	35.9	39.3
Electricity	13.0	12.4	13.7	12.2	10.7	13.7
Energy	52.0	51.5	52.6	50.9	50.0	51.7
Assets	37.6	36.8	38.4	40.0	38.4	41.5

Notes: Survey weights used; confidence intervals were computed using the bootstrap percentile method with 1,000 stratified bootstrap replications (Efron, 1981, p. 145).

Table 3.A.4: Proportion of individuals deprived in various indicators (h %).
Source: Authors' estimates based on 2014-EMNV

	The Whole Population		
Indicator	h	Confidence interval at 95 percent	
		Lower bound	Upper bound
Education	51.7	50.9	52.4
Health	15.1	14.5	15.6
Housing	40.7	40.1	41.3
P. Bedroom	57.2	56.5	57.8
H. Tenure	17.8	17.2	18.4
Water	16.4	15.9	16.9
Sanitation	42.7	42.0	43.3
Electricity	14.3	13.8	14.8
Energy	54.5	54.1	54.9
Assets	39.9	39.4	40.5

Notes: Survey weights used; confidence intervals were computed using the bootstrap percentile method with 1,000 stratified bootstrap replications (Efron, 1981, p. 145).

Table 3.A.5: The incidence of monetary poverty (H %).
Source: Authors' estimates based on data from 2014-EMNV.

Group	H	Confidence interval at 95%*	
		Lower bound	Upper bound
Children	35.3	33.7	37.0
Adolescents	34.4	33.1	35.6
Adults	27.0	26.1	27.8
Elderly	23.5	21.9	25.1
Total	29.6	28.9	30.2

Notes: Survey weights used; confidence intervals were computed using the bootstrap percentile method with 1,000 stratified bootstrap replications (Efron, 1981, p. 145).

Table 3.A.6: The incidence of monetary poverty (H %) by gender.
Source: Authors' estimates based on data from 2014-EMNV

Group	Male			Female			Difference between females and males' estimates	
	H	Confidence interval at 95%*		H	Confidence interval at 95%*			
		Lower bound	Upper bound		Lower bound	Upper bound	Absolute	Relative
Children	35.3	33.0	37.6	35.4	33.2	37.5	0.09*	1.00
Adolescents	35.0	33.2	36.7	33.7	31.9	35.4	-1.30***	0.96
Adults	27.6	26.3	28.8	26.4	25.1	27.5	-1.27***	0.95
Elderly	27.0	24.0	29.6	20.3	18.7	21.9	-6.61***	0.75
Total	30.5	29.5	31.4	28.7	27.8	29.6	-1.75***	0.94

Notes: Survey weights used; confidence intervals were computed using the bootstrap percentile method with 1,000 stratified bootstrap replications (Efron, 1981, p. 145). *Significance levels:* * $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$.

3.B. Appendix

To investigate whether our results are robust to the choice of a multidimensional poverty line, we employ the complementary cumulative distribution function (CCDF)—the complement of a cumulative distribution function (CDF)—put forward by Alkire et al., (2015). Given any value a, the CCDF provides the proportion of the individuals that has scores larger than or equal to a; in our context, it will show the proportion of the multi-dimensionally poor individuals (the multidimensional headcount ratio, H) if the second cut-off is set to a. Given two deprivation score distributions, c and c', with CCDFs $\overline{F}_c$ and $\overline{F}_{c'}$, the distribution c first-order stochastically dominates distribution c' if and only if $\overline{F}_c(a) \geq \overline{F}_{c'}(a)$ for all a and if $\overline{F}_c(a) > \overline{F}_{c'}(a)$ for some a. For strict first-order stochastic dominance condition, the second inequality must hold for all a. Therefore, if c first-order stochastically dominates c', then it has no lower H than distribution c' for all multidimensional poverty lines (k).

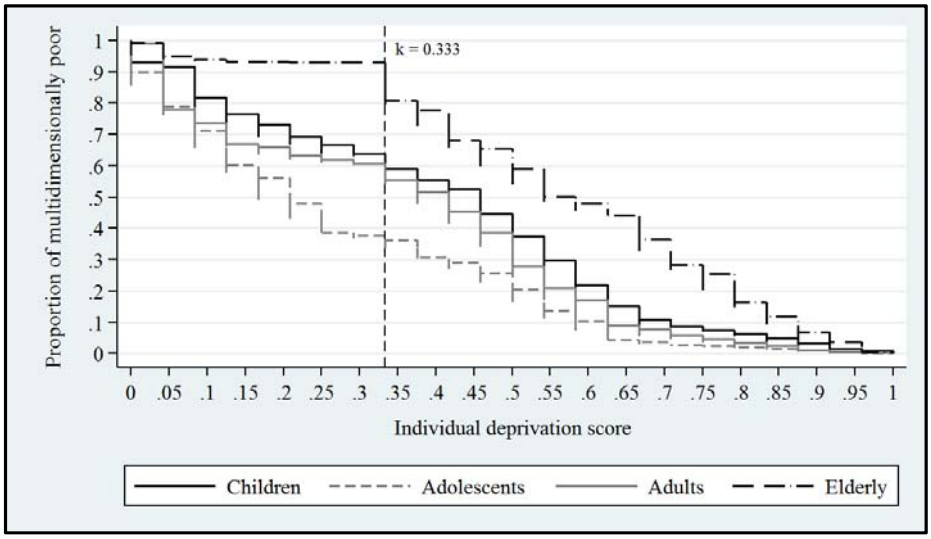

Figure 3.B.1: Complementary cumulative distribution function (CCDF), by group.
Source: Authors' estimates based on 2014-EMNV.

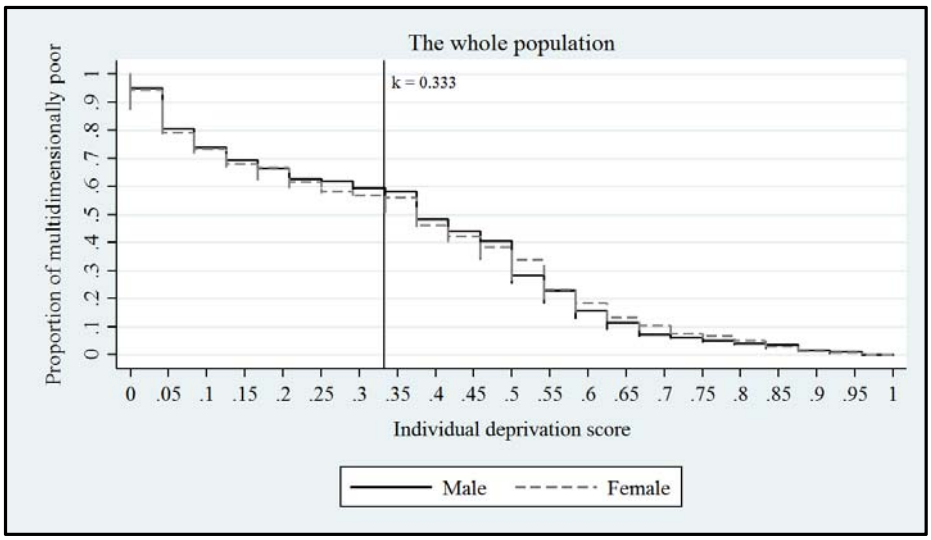

Figure 3.B.2: Complementary cumulative distribution function (CCDF), by gender.
Source: Authors' estimates based on 2014-EMNV.

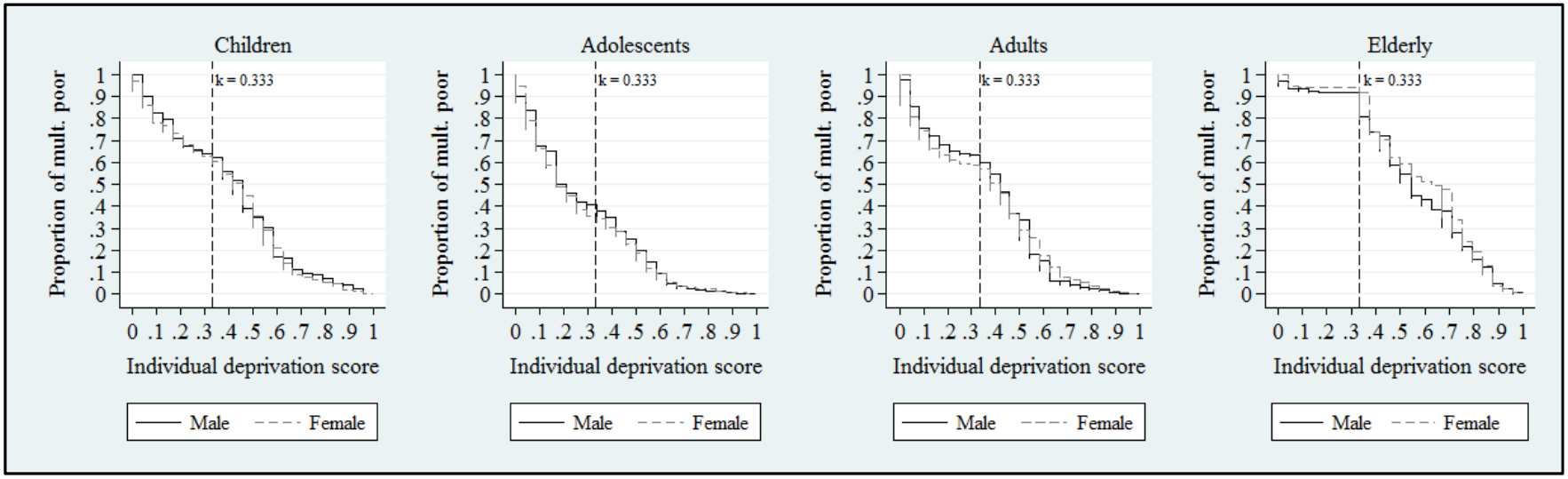

Figure 3.B.3: Complementary cumulative distribution function (CCDF), by age group and gender.
Source: Authors' estimates based on 2014-EMNV.

Figure 3.B.1 depicts the CCDFs for children, adolescents, adults, and elderly for various values of k. The figure makes it clear that no matter what k one chooses, the proportion of multi-dimensionally poor individuals (H) will always be larger for elderly than for children, adolescents, and adults. That is, the elderly's deprivation score distribution first-order stochastically dominates the other ones. Note also that the distribution for children dominates that of adolescents and adults; therefore, we can conclude that in Nicaragua, children and elderly are the most vulnerable people in terms of multidimensional poverty incidence, which is robust to the choice of a multidimensional poverty line (Duclos et al., 2008). It is worth mentioning that for the case of the MPI index (M_0), the conclusion also holds since H dominance implies M_0 dominance as well (second-order dominance) (Alkire et al., 2015).

Figure 3.B.2 and 3.B.3 plot the CCDFs for men and women for different k values, considering both the whole population and the four groups. Overall, we do not find strict first-order stochastic dominance between the CCDFs since the distributions cross each other at least once. But limiting the values of k to a more plausible (or pertinent) range of 20% to 40%, that is, conducting restricted tests of dominance (Alkire and Santos, 2014, p. 265), robust conclusions can be drawn. We find that the men's distributions dominate those of women, men's headcount ratios do not seem to be lower than women's for the restricted range of k values. It is also worthy of note that the smallest sizes of the gender gap are found among children, as was suggested in our analysis. Considering the whole population, this robustness analysis suggests that in Nicaragua, men are slightly more likely to be multi-dimensionally poor than women, which means that multidimensional poverty does not seem to be feminized.

To test whether our findings are robust to a range of weights, we estimated H, A, M_0, and I_q by group and gender, as well as for the whole population, with five alternative weighting structures: i) Giving 50% to living standard and 25% each to education and health, ii) giving 50% to education and 25% each to health and living standard, iii) giving 50% to health and 25% each to education and living standard, iv) giving 20% to living standard and 40% each to education and health to attach more weight to those dimensions that capture fully inequality within the household, and v) giving 0% to living standard and 50% each to education and health to estimate the size of the gender gap using the 100 percent individualized dimensions. The results of the robustness analysis are shown in Tables 3.B.1,

3.B.2, 3.B.3, and 3.B.4; gender differences in absolute and relative terms are also presented in these tables, as well as the corresponding confidence intervals at 95%. In order to ease the comparison of the results, the tables include, additionally, estimates using equal-nested weights, which are considered as the baseline.

We find that the levels of the different measures are sensitive to changes in the weighting structures, but the ranking of the age groups in terms of the poverty incidence and MPI index is fully preserved; in the other cases (intensity and inequality), the ranking is partially held since, in some cases, children, adolescents, and adults switch places. The analysis agrees again with the fact that elderly is the most vulnerable age group in terms of poverty and inequality. The size of the gender gaps in poverty and inequality is also quite sensitive to modifications in the weighting schemes, and, in some cases, the direction of the gaps changes when is compared to the baseline. However, some robust conclusions can be drawn as well: 1) The adolescent and adult males' poverty incidence is larger than females'; 2) the poverty intensity is not greater among adult men and among elderly men than among their female counterparts, but the reverse is true for children; 3) considering the whole population, the multidimensional poverty incidence is not higher among women, but the opposite is true for the intensity; 4) inequality among adolescent females and among adult women is not lower than the one among their male counterparts, whereas the reverse occurs among children; finally, 5) inequality is not really lower among Nicaraguan females than among males. In the remaining cases, the direction of the gap is ambiguous, but, overall, the size of the gap is quite similar to that of the baseline, respectively.

Table 3.B.1: Multidimensional poverty incidence (H %) in Nicaragua, using six alternative weighting structures.
Source: Authors' estimates based on 2014-EMNV.

Weighting structure	Children			Male children			Female children			Gender differences	
	Lb	**H**	Ub	Lb	**H**	Ub	Lb	**H**	Ub	Absolute	Relative
Education (33.3%) Health (33.3%) Living Standard (33.3%)	61.7	**63.3**	64.9	61.8	**63.9**	66.1	60.4	**62.7**	64.9	-1.27***	0.98
Education (25%) Health (25%) Living Standard (50%)	55.4	**56.8**	58.1	54.2	**56.2**	58.1	55.4	**57.4**	59.4	1.21***	1.02
Education (50%) Health (25%) Living Standard (25%)	58.2	**59.7**	61.2	57.8	**60.0**	62.1	57.2	**59.4**	61.5	-0.60***	0.99
Education (25%) Health (50%) Living Standard (25%)	47.7	**49.4**	50.9	46.7	**48.8**	50.8	47.5	**49.9**	52.3	1.03***	1.02
Education (40%) Health (40%) Living Standard (20%)	61.3	**62.9**	64.5	61.5	**63.5**	65.6	60.1	**62.4**	64.6	-1.15***	0.98
Education (50%) Health (50%) Living Standard (0%)	61.4	**62.9**	64.5	61.3	**63.5**	65.8	60.1	**62.4**	64.7	-1.18***	0.98
Weighting structure	Adolescents			Male adolescents			Female adolescents			Gender differences	
	Lb	**H**	Ub	Lb	**H**	Ub	Lb	**H**	Ub	Absolute	Relative
Education (33.3%) Health (33.3%) Living Standard (33.3%)	35.2	**36.6**	37.9	36.4	**38.2**	40.0	33.0	**34.9**	36.8	-3.30***	0.91
Education (25%) Health (25%) Living Standard (50%)	35.7	**37.0**	38.3	36.4	**38.2**	39.9	33.8	**35.6**	37.4	-2.68***	0.93
Education (50%) Health (25%) Living Standard (25%)	31.6	**32.8**	34.2	33.3	**35.0**	36.9	28.7	**30.6**	32.5	-4.39***	0.87
Education (25%) Health (50%) Living Standard (25%)	29.1	**30.3**	31.6	28.9	**30.7**	32.6	28.0	**30.0**	31.9	-0.71***	0.98
Education (40%) Health (40%) Living Standard (20%)	35.0	**36.3**	37.6	35.9	**37.8**	39.7	32.7	**34.7**	36.7	-3.06***	0.92
Education (50%) Health (50%) Living Standard (0%)	34.9	**36.3**	37.6	36.0	**37.8**	39.7	32.6	**34.7**	36.7	-3.12***	0.92
Weighting structure	Adults			Male adults			Female adults			Gender differences	
	Lb	**H**	Ub	Lb	**H**	Ub	Lb	**H**	Ub	Absolute	Relative
Education (33.3%) Health (33.3%) Living Standard (33.3%)	59.7	**60.5**	61.4	61.5	**62.7**	63.9	57.3	**58.5**	59.7	-4.21***	0.93
Education (25%) Health (25%) Living Standard (50%)	48.8	**49.7**	50.4	50.8	**51.8**	52.8	46.6	**47.7**	48.8	-4.02***	0.92
Education (50%) Health (25%) Living Standard (25%)	55.9	**56.8**	57.6	58.6	**59.9**	61.0	52.9	**54.1**	55.2	-5.79***	0.90
Education (25%) Health (50%) Living Standard (25%)	44.5	**45.4**	46.2	44.6	**45.8**	47.0	43.8	**45.0**	46.1	-0.87***	0.98
Education (40%) Health (40%) Living Standard (20%)	59.5	**60.4**	61.3	61.3	**62.7**	63.8	57.1	**58.4**	59.6	-4.26***	0.93
Education (50%) Health (50%) Living Standard (0%)	59.6	**60.5**	61.3	61.4	**62.7**	63.9	57.2	**58.5**	59.7	-4.19***	0.93
Weighting structure	Elderly			Male elderly			Female elderly			Gender differences	
	Lb	**H**	Ub	Lb	**H**	Ub	Lb	**H**	Ub	Absolute	Relative
Education (33.3%) Health (33.3%) Living Standard (33.3%)	92.2	**92.9**	93.7	90.6	**91.6**	92.6	93.0	**94.1**	95.3	2.52***	1.03
Education (25%) Health (25%) Living Standard (50%)	71.6	**72.7**	73.9	71.8	**73.2**	74.6	70.6	**72.3**	74.2	-0.86***	0.99
Education (50%) Health (25%) Living Standard (25%)	84.0	**84.9**	85.9	83.0	**84.3**	85.5	83.8	**85.4**	86.7	1.12***	1.01
Education (25%) Health (50%) Living Standard (25%)	72.5	**73.8**	75.1	70.7	**72.7**	74.4	72.8	**74.7**	76.6	2.07***	1.03
Education (40%) Health (40%) Living Standard (20%)	92.2	**92.9**	93.7	90.7	**91.6**	92.5	93.0	**94.2**	95.4	2.55***	1.03
Education (50%) Health (50%) Living Standard (0%)	92.1	**92.9**	93.7	90.7	**91.6**	92.5	93.1	**94.2**	95.4	2.57***	1.03
Weighting structure	The whole population			Male			Female			Gender differences	
	Lb	**H**	Ub	Lb	**H**	Ub	Lb	**H**	Ub	Absolute	Relative
Education (33.3%) Health (33.3%) Living Standard (33.3%)	57.0	**57.6**	58.3	57.8	**58.9**	60.0	55.5	**56.5**	57.5	-2.41***	0.96
Education (25%) Health (25%) Living Standard (50%)	48.7	**49.3**	50.0	49.8	**50.6**	51.5	47.2	**48.1**	49.1	-2.47***	0.95
Education (50%) Health (25%) Living Standard (25%)	52.8	**53.6**	54.2	54.5	**55.5**	56.5	51.0	**51.8**	52.8	-3.63***	0.93
Education (25%) Health (50%) Living Standard (25%)	43.8	**44.5**	45.2	43.5	**44.5**	45.5	43.6	**44.5**	45.7	0.07***	1.00
Education (40%) Health (40%) Living Standard (20%)	56.7	**57.5**	58.2	57.7	**58.7**	59.7	55.2	**56.3**	57.4	-2.36***	0.96
Education (50%) Health (50%) Living Standard (0%)	56.7	**57.5**	58.2	57.5	**58.6**	59.7	55.2	**56.3**	57.3	-2.32***	0.96

Notes: Lb: Lower bound; Ub: Upper bound; survey weights used; confidence intervals were computed using the bootstrap percentile method with 1,000 stratified bootstrap replications (Efron, 1981, p. 145). *Significance levels:* * $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$.

Table 3.B.2: Multidimensional poverty intensity (A), using six alternative weighting structures.
Source: Authors' estimates based on 2014-EMNV.

Weighting structure	Children			Male children			Female children			Gender differences	
	Lb	**A**	Ub	Lb	**A**	Ub	Lb	**A**	Ub	Absolute	Relative
Education (33.3%) Health (33.3%) Living Standard (33.3%)	0.5343	**0.5406**	0.5470	0.5327	**0.5415**	0.5497	0.5312	**0.5394**	0.5487	-0.0020***	1.00
Education (25%) Health (25%) Living Standard (50%)	0.5525	**0.5589**	0.5659	0.5531	**0.5632**	0.5719	0.5452	**0.5548**	0.5638	-0.0084***	0.99
Education (50%) Health (25%) Living Standard (25%)	0.6440	**0.6494**	0.6554	0.6440	**0.6522**	0.6605	0.6386	**0.6467**	0.6549	-0.0055***	0.99
Education (25%) Health (50%) Living Standard (25%)	0.5097	**0.5194**	0.5294	0.5165	**0.5285**	0.5404	0.4975	**0.5104**	0.5236	-0.0181***	0.97
Education (40%) Health (40%) Living Standard (20%)	0.5483	**0.5549**	0.5617	0.5488	**0.5579**	0.5671	0.5437	**0.5522**	0.5612	-0.0057***	0.99
Education (50%) Health (50%) Living Standard (0%)	0.5673	**0.5748**	0.5828	0.5695	**0.5799**	0.5904	0.5590	**0.5697**	0.5817	-0.0102***	0.98
Weighting structure	Adolescents			Male adolescents			Female adolescents			Gender differences	
	Lb	**A**	Ub	Lb	**A**	Ub	Lb	**A**	Ub	Absolute	Relative
Education (33.3%) Health (33.3%) Living Standard (33.3%)	0.5163	**0.5208**	0.5256	0.5159	**0.5218**	0.5274	0.5128	**0.5200**	0.5278	-0.0018***	1.00
Education (25%) Health (25%) Living Standard (50%)	0.5236	**0.5294**	0.5351	0.5265	**0.5340**	0.5421	0.5160	**0.5241**	0.5329	-0.0099***	0.98
Education (50%) Health (25%) Living Standard (25%)	0.6146	**0.6205**	0.6264	0.6203	**0.6279**	0.6351	0.6021	**0.6120**	0.6221	-0.0158***	0.97
Education (25%) Health (50%) Living Standard (25%)	0.4941	**0.5016**	0.5098	0.4828	**0.4915**	0.5013	0.5008	**0.5127**	0.5245	0.0212***	1.04
Education (40%) Health (40%) Living Standard (20%)	0.5257	**0.5304**	0.5354	0.5240	**0.5298**	0.5358	0.5231	**0.5310**	0.5396	0.0012***	1.00
Education (50%) Health (50%) Living Standard (0%)	0.5364	**0.5421**	0.5478	0.5327	**0.5391**	0.5459	0.5361	**0.5455**	0.5562	0.0064***	1.01
Weighting structure	Adults			Male adults			Female adults			Gender differences	
	Lb	**A**	Ub	Lb	**A**	Ub	Lb	**A**	Ub	Absolute	Relative
Education (33.3%) Health (33.3%) Living Standard (33.3%)	0.5098	**0.5128**	0.5158	0.5005	**0.5044**	0.5082	0.5163	**0.5211**	0.5258	0.0167***	1.03
Education (25%) Health (25%) Living Standard (50%)	0.5373	**0.5407**	0.5440	0.5290	**0.5337**	0.5386	0.5420	**0.5473**	0.5523	0.0137***	1.03
Education (50%) Health (25%) Living Standard (25%)	0.6370	**0.6395**	0.6420	0.6291	**0.6321**	0.6352	0.6431	**0.6470**	0.6510	0.0149***	1.02
Education (25%) Health (50%) Living Standard (25%)	0.4749	**0.4799**	0.4850	0.4522	**0.4584**	0.4648	0.4919	**0.4998**	0.5074	0.0414***	1.09
Education (40%) Health (40%) Living Standard (20%)	0.5275	**0.5309**	0.5342	0.5153	**0.5193**	0.5236	0.5368	**0.5421**	0.5474	0.0228***	1.04
Education (50%) Health (50%) Living Standard (0%)	0.5531	**0.5574**	0.5615	0.5364	**0.5411**	0.5460	0.5669	**0.5732**	0.5795	0.0321***	1.06
Weighting structure	Elderly			Male elderly			Female elderly			Gender differences	
	Lb	**A**	Ub	Lb	**A**	Ub	Lb	**A**	Ub	Absolute	Relative
Education (33.3%) Health (33.3%) Living Standard (33.3%)	0.5849	**0.5924**	0.5997	0.5734	**0.5862**	0.5984	0.5896	**0.5983**	0.6069	0.0121***	1.02
Education (25%) Health (25%) Living Standard (50%)	0.5837	**0.5909**	0.5983	0.5784	**0.5909**	0.6037	0.5834	**0.5907**	0.5985	-0.0001	1.00
Education (50%) Health (25%) Living Standard (25%)	0.7041	**0.7105**	0.7165	0.6937	**0.7034**	0.7128	0.7106	**0.7172**	0.7241	0.0139***	1.02
Education (25%) Health (50%) Living Standard (25%)	0.6527	**0.6642**	0.6748	0.6167	**0.6374**	0.6555	0.6759	**0.6877**	0.7001	0.0502***	1.08
Education (40%) Health (40%) Living Standard (20%)	0.6407	**0.6495**	0.6575	0.6206	**0.6340**	0.6479	0.6529	**0.6633**	0.6727	0.0293***	1.05
Education (50%) Health (50%) Living Standard (0%)	0.7244	**0.7347**	0.7444	0.6884	**0.7052**	0.7220	0.7494	**0.7616**	0.7744	0.0565***	1.08
Weighting structure	The whole population			Male			Female			Gender differences	
	Lb	**A**	Ub	Lb	**A**	Ub	Lb	**A**	Ub	Absolute	Relative
Education (33.3%) Health (33.3%) Living Standard (33.3%)	0.5258	**0.5285**	0.5312	0.5190	**0.5227**	0.5266	0.5301	**0.5339**	0.5380	0.0113***	1.02
Education (25%) Health (25%) Living Standard (50%)	0.5443	**0.5473**	0.5506	0.5405	**0.5448**	0.5494	0.5453	**0.5498**	0.5544	0.0050***	1.01
Education (50%) Health (25%) Living Standard (25%)	0.6447	**0.6472**	0.6498	0.6395	**0.6429**	0.6463	0.6478	**0.6518**	0.6556	0.0089***	1.01
Education (25%) Health (50%) Living Standard (25%)	0.5097	**0.5141**	0.5186	0.4914	**0.4978**	0.5049	0.5232	**0.5295**	0.5359	0.0318***	1.06
Education (40%) Health (40%) Living Standard (20%)	0.5466	**0.5497**	0.5529	0.5365	**0.5406**	0.5452	0.5545	**0.5587**	0.5633	0.0181***	1.03
Education (50%) Health (50%) Living Standard (0%)	0.5768	**0.5807**	0.5843	0.5615	**0.5666**	0.5716	0.5893	**0.5947**	0.6003	0.0280***	1.05

Notes: Lb: Lower bound; Ub: Upper bound; survey weights used; confidence intervals were computed using the bootstrap percentile method with 1,000 stratified bootstrap replications (Efron, 1981, p. 145). *Significance levels:* * $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$.

Table 3.B.3: Adjusted headcount ratio (M_0), MPI index, using six alternative weighting structures.
Source: Authors' estimates based on 2014-EMNV.

Weighting structure	Children			Male children			Female children			Gender differences	
	Lb	**M_0**	Ub	Lb	**M_0**	Ub	Lb	**M_0**	Ub	Absolute	Relative
Education (33.3%) Health (33.3%) Living Standard (33.3%)	0.3318	**0.3419**	0.3512	0.3324	**0.3463**	0.3599	0.3241	**0.3378**	0.3514	-0.0085***	0.98
Education (25%) Health (25%) Living Standard (50%)	0.3091	**0.3175**	0.3259	0.3043	**0.3166**	0.3291	0.3065	**0.3184**	0.3297	0.0018***	1.01
Education (50%) Health (25%) Living Standard (25%)	0.3755	**0.3877**	0.3996	0.3749	**0.3907**	0.4066	0.3683	**0.3843**	0.3995	-0.0064***	0.98
Education (25%) Health (50%) Living Standard (25%)	0.2469	**0.2566**	0.2663	0.2448	**0.2583**	0.2714	0.2403	**0.2549**	0.2687	-0.0034***	0.99
Education (40%) Health (40%) Living Standard (20%)	0.3394	**0.3493**	0.3594	0.3402	**0.3538**	0.3679	0.3303	**0.3445**	0.3585	-0.0094***	0.97
Education (50%) Health (50%) Living Standard (0%)	0.3509	**0.3614**	0.3722	0.3519	**0.3673**	0.3822	0.3404	**0.3556**	0.3700	-0.0117***	0.97
Weighting structure	Adolescents			Male adolescents			Female adolescents			Gender differences	
	Lb	**M_0**	Ub	Lb	**M_0**	Ub	Lb	**M_0**	Ub	Absolute	Relative
Education (33.3%) Health (33.3%) Living Standard (33.3%)	0.1832	**0.1907**	0.1984	0.1888	**0.1995**	0.2109	0.1708	**0.1817**	0.1921	-0.0179***	0.91
Education (25%) Health (25%) Living Standard (50%)	0.1890	**0.1958**	0.2022	0.1947	**0.2044**	0.2141	0.1762	**0.1867**	0.1962	-0.0177***	0.91
Education (50%) Health (25%) Living Standard (25%)	0.1957	**0.2042**	0.2125	0.2083	**0.2198**	0.2315	0.1749	**0.1874**	0.2000	-0.0324***	0.85
Education (25%) Health (50%) Living Standard (25%)	0.1448	**0.1521**	0.1592	0.1411	**0.1506**	0.1598	0.1429	**0.1537**	0.1650	0.0031***	1.02
Education (40%) Health (40%) Living Standard (20%)	0.1846	**0.1925**	0.1996	0.1889	**0.2002**	0.2103	0.1734	**0.1841**	0.1947	-0.0160***	0.92
Education (50%) Health (50%) Living Standard (0%)	0.1886	**0.1964**	0.2042	0.1933	**0.2040**	0.2153	0.1786	**0.1894**	0.2008	-0.0146***	0.93
Weighting structure	Adults			Male adults			Female adults			Gender differences	
	Lb	**M_0**	Ub	Lb	**M_0**	Ub	Lb	**M_0**	Ub	Absolute	Relative
Education (33.3%) Health (33.3%) Living Standard (33.3%)	0.3060	**0.3105**	0.3153	0.3100	**0.3167**	0.3231	0.2985	**0.3051**	0.3123	-0.0116***	0.96
Education (25%) Health (25%) Living Standard (50%)	0.2640	**0.2683**	0.2725	0.2708	**0.2764**	0.2824	0.2549	**0.2613**	0.2678	-0.0151***	0.95
Education (50%) Health (25%) Living Standard (25%)	0.3571	**0.3630**	0.3689	0.3702	**0.3783**	0.3861	0.3418	**0.3498**	0.3583	-0.0285***	0.92
Education (25%) Health (50%) Living Standard (25%)	0.2129	**0.2177**	0.2223	0.2039	**0.2102**	0.2164	0.2171	**0.2245**	0.2316	0.0144***	1.07
Education (40%) Health (40%) Living Standard (20%)	0.3159	**0.3206**	0.3258	0.3187	**0.3254**	0.3322	0.3095	**0.3168**	0.3247	-0.0087***	0.97
Education (50%) Health (50%) Living Standard (0%)	0.3312	**0.3369**	0.3423	0.3320	**0.3391**	0.3465	0.3260	**0.3347**	0.3428	-0.0044***	0.99
Weighting structure	Elderly			Male elderly			Female elderly			Gender differences	
	Lb	**M_0**	Ub	Lb	**M_0**	Ub	Lb	**M_0**	Ub	Absolute	Relative
Education (33.3%) Health (33.3%) Living Standard (33.3%)	0.5422	**0.5510**	0.5596	0.5246	**0.5370**	0.5492	0.5522	**0.5631**	0.5744	0.0261***	1.05
Education (25%) Health (25%) Living Standard (50%)	0.4802	**0.4872**	0.4945	0.4757	**0.4865**	0.4971	0.4779	**0.4875**	0.4963	0.0009***	1.00
Education (50%) Health (25%) Living Standard (25%)	0.6178	**0.6256**	0.6335	0.6035	**0.6140**	0.6247	0.6260	**0.6361**	0.6464	0.0221***	1.04
Education (25%) Health (50%) Living Standard (25%)	0.5336	**0.5446**	0.5550	0.5017	**0.5188**	0.5356	0.5556	**0.5686**	0.5829	0.0498***	1.10
Education (40%) Health (40%) Living Standard (20%)	0.5952	**0.6044**	0.6140	0.5685	**0.5823**	0.5953	0.6128	**0.6254**	0.6382	0.0431***	1.07
Education (50%) Health (50%) Living Standard (0%)	0.6718	**0.6829**	0.6947	0.6287	**0.6457**	0.6637	0.7011	**0.7167**	0.7331	0.0710***	1.11
Weighting structure	The whole population			Male			Female			Gender differences	
	Lb	**M_0**	Ub	Lb	**M_0**	Ub	Lb	**M_0**	Ub	Absolute	Relative
Education (33.3%) Health (33.3%) Living Standard (33.3%)	0.3013	**0.3046**	0.3084	0.3031	**0.3079**	0.3127	0.2965	**0.3015**	0.3066	-0.0064***	0.98
Education (25%) Health (25%) Living Standard (50%)	0.3414	**0.3440**	0.3464	0.3455	**0.3489**	0.3522	0.3359	**0.3393**	0.3427	-0.0096***	0.97
Education (50%) Health (25%) Living Standard (25%)	0.3813	**0.3846**	0.3880	0.3872	**0.3921**	0.3970	0.3727	**0.3775**	0.3820	-0.0147***	0.96
Education (25%) Health (50%) Living Standard (25%)	0.2902	**0.2930**	0.2961	0.2851	**0.2892**	0.2932	0.2931	**0.2969**	0.3007	0.0077***	1.03
Education (40%) Health (40%) Living Standard (20%)	0.3344	**0.3378**	0.3411	0.3346	**0.3390**	0.3432	0.3320	**0.3365**	0.3414	-0.0024***	0.99
Education (50%) Health (50%) Living Standard (0%)	0.3298	**0.3337**	0.3379	0.3275	**0.3325**	0.3378	0.3295	**0.3348**	0.3408	0.0023***	1.01

Notes: Lb: Lower bound; Ub: Upper bound; survey weights used; confidence intervals were computed using the bootstrap percentile method with 1,000 stratified bootstrap replications (Efron, 1981, p. 145). *Significance levels:* * $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$.

Table 3.B.4: Inequality among the multi-dimensionally poor (I_q), using six alternative weighting structures.
Source: Authors' estimates based on 2014-EMNV.

Weighting structure	Children			Male children			Female children			Gender differences	
	Lb	**Iq**	Ub	Lb	**Iq**	Ub	Lb	**Iq**	Ub	Absolute	Relative
Education (33.3%) Health (33.3%) Living Standard (33.3%)	0.0860	**0.0934**	0.1014	0.0914	**0.1015**	0.1109	0.0744	**0.0854**	0.0970	-0.0162***	0.84
Education (25%) Health (25%) Living Standard (50%)	0.0741	**0.0801**	0.0861	0.0786	**0.0867**	0.0950	0.0654	**0.0733**	0.0813	-0.0134***	0.85
Education (50%) Health (25%) Living Standard (25%)	0.0629	**0.0680**	0.0731	0.0654	**0.0720**	0.0789	0.0568	**0.0639**	0.0713	-0.0081***	0.89
Education (25%) Health (50%) Living Standard (25%)	0.1327	**0.1439**	0.1543	0.1377	**0.1535**	0.1680	0.1170	**0.1334**	0.1506	-0.0201***	0.87
Education (40%) Health (40%) Living Standard (20%)	0.0877	**0.0962**	0.1046	0.0916	**0.1037**	0.1146	0.0763	**0.0878**	0.0997	-0.0159***	0.85
Education (50%) Health (50%) Living Standard (0%)	0.1163	**0.1270**	0.1371	0.1190	**0.1333**	0.1479	0.1042	**0.1205**	0.1370	-0.0129***	0.90
Weighting structure	Adolescents			Male adolescents			Female adolescents			Gender differences	
	Lb	**Iq**	Ub	Lb	**Iq**	Ub	Lb	**Iq**	Ub	Absolute	Relative
Education (33.3%) Health (33.3%) Living Standard (33.3%)	0.0633	**0.0691**	0.0753	0.0598	**0.0671**	0.0748	0.0613	**0.0714**	0.0815	0.0043***	1.06
Education (25%) Health (25%) Living Standard (50%)	0.0631	**0.0680**	0.0731	0.0619	**0.0682**	0.0752	0.0594	**0.0672**	0.0758	-0.0010***	0.99
Education (50%) Health (25%) Living Standard (25%)	0.0645	**0.0695**	0.0744	0.0539	**0.0600**	0.0657	0.0722	**0.0805**	0.0894	0.0205***	1.34
Education (25%) Health (50%) Living Standard (25%)	0.0889	**0.0977**	0.1072	0.0817	**0.0923**	0.1038	0.0896	**0.1024**	0.1161	0.0101***	1.11
Education (40%) Health (40%) Living Standard (20%)	0.0552	**0.0622**	0.0695	0.0505	**0.0584**	0.0664	0.0551	**0.0668**	0.0787	0.0084***	1.14
Education (50%) Health (50%) Living Standard (0%)	0.0673	**0.0772**	0.0878	0.0605	**0.0719**	0.0840	0.0673	**0.0830**	0.1004	0.0111***	1.16
Weighting structure	Adults			Male adults			Female adults			Gender differences	
	Lb	**Iq**	Ub	Lb	**Iq**	Ub	Lb	**Iq**	Ub	Absolute	Relative
Education (33.3%) Health (33.3%) Living Standard (33.3%)	0.0676	**0.0714**	0.0754	0.0569	**0.0615**	0.0664	0.0746	**0.0802**	0.0863	0.0187***	1.30
Education (25%) Health (25%) Living Standard (50%)	0.0551	**0.0579**	0.0611	0.0510	**0.0546**	0.0582	0.0563	**0.0608**	0.0655	0.0062***	1.11
Education (50%) Health (25%) Living Standard (25%)	0.0399	**0.0420**	0.0441	0.0330	**0.0355**	0.0384	0.0447	**0.0482**	0.0517	0.0127***	1.36
Education (25%) Health (50%) Living Standard (25%)	0.1022	**0.1087**	0.1155	0.0793	**0.0881**	0.0968	0.1147	**0.1237**	0.1324	0.0356***	1.40
Education (40%) Health (40%) Living Standard (20%)	0.0677	**0.0721**	0.0768	0.0513	**0.0568**	0.0621	0.0793	**0.0857**	0.0923	0.0289***	1.51
Education (50%) Health (50%) Living Standard (0%)	0.0957	**0.1017**	0.1078	0.0679	**0.0753**	0.0828	0.1161	**0.1249**	0.1351	0.0497***	1.66
Weighting structure	Elderly			Male elderly			Female elderly			Gender differences	
	Lb	**Iq**	Ub	Lb	**Iq**	Ub	Lb	**Iq**	Ub	Absolute	Relative
Education (33.3%) Health (33.3%) Living Standard (33.3%)	0.1372	**0.1431**	0.1490	0.1318	**0.1416**	0.1521	0.1369	**0.1443**	0.1519	0.0027***	1.02
Education (25%) Health (25%) Living Standard (50%)	0.0751	**0.0810**	0.0866	0.0774	**0.0860**	0.0949	0.0691	**0.0766**	0.0838	-0.0094***	0.89
Education (50%) Health (25%) Living Standard (25%)	0.0731	**0.0763**	0.0795	0.0733	**0.0784**	0.0836	0.0696	**0.0741**	0.0779	-0.0043***	0.95
Education (25%) Health (50%) Living Standard (25%)	0.1681	**0.1725**	0.1766	0.1845	**0.1905**	0.1970	0.1461	**0.1514**	0.1567	-0.0391***	0.79
Education (40%) Health (40%) Living Standard (20%)	0.1670	**0.1714**	0.1756	0.1595	**0.1680**	0.1760	0.1680	**0.1729**	0.1780	0.0048***	1.03
Education (50%) Health (50%) Living Standard (0%)	0.2475	**0.2490**	0.2499	0.2345	**0.2416**	0.2471	0.2476	**0.2493**	0.2500	0.0077***	1.03
Weighting structure	The whole population			Male			Female			Gender differences	
	Lb	**Iq**	Ub	Lb	**Iq**	Ub	Lb	**Iq**	Ub	Absolute	Relative
Education (33.3%) Health (33.3%) Living Standard (33.3%)	0.0832	**0.0864**	0.0897	0.0761	**0.0811**	0.0859	0.0868	**0.0911**	0.0958	0.0100***	1.12
Education (25%) Health (25%) Living Standard (50%)	0.0646	**0.0671**	0.0699	0.0636	**0.0672**	0.0709	0.0635	**0.0670**	0.0705	-0.0002*	1.00
Education (50%) Health (25%) Living Standard (25%)	0.0546	**0.0569**	0.0591	0.0493	**0.0521**	0.0552	0.0583	**0.0617**	0.0649	0.0096***	1.18
Education (25%) Health (50%) Living Standard (25%)	0.1305	**0.1353**	0.1403	0.1175	**0.1257**	0.1336	0.1358	**0.1419**	0.1482	0.0162***	1.13
Education (40%) Health (40%) Living Standard (20%)	0.0891	**0.0932**	0.0972	0.0777	**0.0832**	0.0890	0.0970	**0.1024**	0.1075	0.0192***	1.23
Education (50%) Health (50%) Living Standard (0%)	0.1300	**0.1353**	0.1406	0.1081	**0.1154**	0.1232	0.1462	**0.1533**	0.1609	0.0379***	1.33

Notes: Lb: Lower bound; Ub: Upper bound; survey weights used; confidence intervals were computed using the bootstrap percentile method with 1,000 stratified bootstrap replications (Efron, 1981, p. 145). *Significance levels:* * $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$.

4. Multidimensional poverty in Central America and gender differences in the three I's of poverty: applying inequality sensitive poverty measures with ordinal (dichotomized) variables[78]

Abstract

The Alkire and Foster (2011a) methodology, as the mainstream approach to the measurement of multidimensional poverty in the developing world, is insensitive to inequality among the multi-dimensionally poor individuals and does not consider simultaneously the concepts of efficiency and distributive justice. Moreover, the vast majority of empirical indices of multidimensional poverty in the literature overlook intra-household inequalities, an issue that is crucial to a better understanding of gender inequalities, because they equate the poverty status of the household with the poverty status of all individuals in the household. Consequently, using the general framework proposed by Silber and Yalonetzky (2014) and Rippin's ideas on multidimensional poverty measurement (2013, 2017), we propose in this essay to depart somehow from the mainstream approach and take an individual-based and inequality sensitive view of multidimensional poverty when only ordinal (dichotomized) variables are available. We use such an approach to estimate multidimensional poverty among individuals aged 18 to 59 years living in Guatemala, El Salvador, Honduras, Nicaragua, and Costa Rica, shedding thus some light on gender differences in poverty and inequality in those countries. Overall, we find that individuals living in Guatemala have the highest probability of being multi-dimensionally poor, followed by the ones in Nicaragua; people living in Costa Rica, by contrast, have by far the lowest probability of being poor. In the middle appear Honduras and El Salvador, Hondurans having a larger probability of being multi-dimensionally poor than the Salvadorians. Regarding the gender gaps, the overall estimates suggest that the incidence and the intensity of multidimensional poverty in Central America are higher among females; inequality, however, is somewhat higher among males.

[78] This chapter is based on joint work with Jacques Silber. Previous versions of this Essay were presented at the ZIF Summer School 2017, University of Bielefeld, and at the Goettingen Development Economics Seminars. We are grateful to participants in these academic events for helpful comments and discussions on the topic, especially to Achille Lemmi and Stephan Klasen. We would also like to thank Nicole Rippin for clarifications and useful discussions on the Correlation Sensitive Poverty Index. José Espinoza-Delgado would also like to acknowledge financial support by the German Academic Exchange Service.

4.1. Introduction

The removal of poverty remains one of the most important aims of economic policy in many countries of the world (Chakravarty, 2018; Chakravarty & Lugo, 2016; Chakravarty & Silber, 2008); it continues to be one of the greatest global challenges and is an essential "requirement for sustainable development" (UN, 2017, p. 1). In consequence, given that there is no meaningful development without the elimination of that source of unfreedom (Sen, 2000a), Goal 1 of the Sustainable Development Goals (SDGs) calls for ending "poverty in all its forms everywhere" (UN, 2015b, p. 15). In this context, specifying how poverty is characterized, what its determinants are, and finding appropriate poverty measures become crucial elements for the design and assessment of policies aimed at the alleviation of this social problem (Ray, 1998).

As argued by Stiglitz et al., (2009a), the well-being of a population is multidimensional. Poverty therefore may be considered as a manifestation of the insufficiency of accomplishments in different domains of well-being (Chakravarty, 2006, 2018; Chakravarty & Lugo, 2016). It is a multidimensional phenomenon characterized by deprivations in multiple dimensions of the individuals' well-being (Ferreira, 2011). As observed by Sen (2000b, p. 18), "human lives are battered and diminished in all kinds of different ways". As a result, nowadays, the multidimensional nature of poverty enjoys a widespread consensus (Chakravarty, 2018; Kakwani & Silber, 2008a; Silber & Yalonetzky, 2014; Stiglitz, Sen, & Fitoussi, 2009a, 2009b), grounded, mainly, on the capability approach proposed by Sen (1985, 1992, 1997, 2000a, 2010), which is regarded as the most comprehensive approach to grasp the concept of poverty (Thorbecke, 2008). Such a consensus is reflected in Target 1.2 of the SDGs, which demands by 2030, the reduction "at least by half of the proportion of men, women and children of all ages living in poverty in all its dimensions according to national definitions" (UN, 2015b, p. 15).

In this regard, multidimensional approaches to the measurement of poverty,[79] as well as multidimensional poverty indices, have become increasingly popular in recent years (Duclos & Tiberti, 2016). Currently, the most influential and dominating methodology in

[79] See, for instance, Alkire and Foster (2011a); Alkire, et al. (2015); Atkinson (2003); Bourguignon and Chakravarty (2003); Brandolini and Aaberge (2014); Chakravarty (2018); Chakravarty, Deutsch, and Silber (2008); Deutsch and Silber (2005); Duclos, Sahn, and Younger (2008); Kakwani and Silber (2008b); Klasen (2000); Lemmi and Betti (2006, 2013); Rippin (2013, 2016, 2017); Tsui (2002).

developing countries, particularly in Latin America and the Caribbean, is the counting approach proposed by Alkire and Foster (2011a) (AF hereafter). It is an axiomatic family of multidimensional poverty measures that employs a "dual cutoff method" for the identification of the poor (Alkire & Foster, 2011a, p. 478), and it has been applied in a considerable number of studies (Duclos & Tiberti, 2016).[80] The most famous application of this approach is the household-based multidimensional poverty index or "global MPI" (Alkire et al., 2015, p. 177). Developed originally by the Oxford Poverty and Human Development Initiative (OPHI) in collaboration with the United Nations Development Program (UNDP) (Alkire & Santos, 2010, 2014), the global MPI has been included in the Human Development Report since 2010 (UNDP, 2010) and has become very popular (Duclos & Tiberti, 2016, p. 696). More recently, Duryea and Robles (2017), as part of the report "Social Pulse in Latin America and the Caribbean 2017", published by the Inter-American Development Bank (IDB), and Santos and Villatoro (2018), who proposed a multidimensional poverty index for Latin America (MPI-LA, hereafter), have also suggested adopting the AF method to estimate household-based multidimensional poverty in Latin America and the Caribbean. Likewise, several Governments, especially from Latin American countries, for instance Chile (Ministerio de Desarrollo Social, 2016), Colombia (DANE-DIMPE, 2014), Costa Rica (INEC-CR, 2015), Ecuador (Castillo & Jácome, 2015), El Salvador (STPP & MINEC-DIGESTYC, 2015), Honduras (SCGG-INE, 2016), Mexico (CONEVAL, 2011), and Panama (MEF, 2017), have adopted such an approach to produce their official multidimensional poverty measure.

The AF methodology has certainly the advantage of simplicity, flexibility, and clarity when compared to other multidimensional approaches, which is indeed what makes it extremely appealing (Silber, 2011; Thorbecke, 2011); it has also a number of attractive properties (see Alkire & Foster, 2011; Alkire et al., 2015). Yet, this approach has also several methodological shortcomings that have often been ignored in the literature (see, Duclos & Tiberti, 2016). Let us focus on two of them, perhaps the most critical weaknesses of the methodology. Firstly, the identification method of the AF methodology assumes implicitly that up to the second (intermediate) cutoff (k), which is used to identify the multi-dimensionally poor (Alkire & Foster, 2011), the variables (attributes) are "perfect substitutes", whereas the same variables are "perfect complements" from such a cutoff onwards (Rippin, 2017, p. 37), an assumption difficult to justify theoretically. Choosing

[80] A summary of studies that have applied the AF method can be found in Alkire et al. (2015, p. 178-181).

between substitutability and complementarity between attributes when there are more than two of them is certainly not an easy task. This issue, however, is of great significance within a dynamic framework and cannot be ignored (Thorbecke, 2008), would it be only because of its important policy implications (Silber, 2011; Thorbecke, 2011).[81] Secondly, as emphasized by Rippin (2013, 2017), any index based on the AF approach is completely insensitive to inequality among the multi-dimensionally poor, particularly with ordinal or dichotomized variables (attributes), a serious shortcoming according to Sen (1976, 1979). In addition, the AF approach does not satisfy the strongest as well as the weakest form of the axiom of "Sensitivity to Inequality Increasing Switch (SIIS)" (Rippin, 2013, p. 26), a property that is assumed to capture the interaction between allocation efficiency and distributive justice (see, Sen, 1992).[82] For instance, an inequality increasing switch that reduces the weighted deprivation score of the less multi-dimensionally poor individual below the threshold k will always lead to a reduction of the poverty rates, no matter what the relationship between the variables (attributes) is (Rippin, 2017). Such a flaw may lead to biased assessments of the extent of poverty and hence have an impact on social policies, and targeting.

Another issue that has generally been ignored in the literature is that in the vast majority of studies, empirical indices of multidimensional poverty have been computed at the level of the household (Bessell, 2015; Chiappori, 2016; Pogge & Wisor, 2016). In other words, these studies used the household as the unit of analysis to determine who is multi-dimensionally poor and who is not, equating the poverty condition of the household with the poverty condition of all individuals belonging to the household (Espinoza-Delgado & Klasen, 2018). Such an assumption, however, disregards intra-household inequalities that are known

[81] "For instance, for a poverty analysis in the dimensions of education and nutritional status of children, there are production complementarities because better-nourished children learn better. If this complementarity is strong enough, it may overcome the usual ethical judgement that favors the multiply-deprived, so that overall poverty would decline by more if we were to transfer education from poorly nourished to the better nourished, despite the fact that it increases the correlation of the two measures of well-being. Similarly, one might argue that human capital should be granted to those with a higher survival probability (because these assets would vanish following their death). Increasing the correlation of deprivations, and increasing the incidence of multiple deprivations, would then be good for poverty reduction" (Duclos, Sahn, & Younger, 2006, p. 950).

[82] The considerations behind SIIS have been clearly stated by Rippin (2017, p. 33-34): "Poverty measures can even decrease in the face of increasing inequality if and only if the degree of complementarity between poverty dimensions is so strong that the gains in allocation efficiency outweigh the sacrifices on the side of distributional justice. In other words, changes in poverty measures ought not to be reduced to considerations of who gains and who loses from redistributions (distributive justice) but should also take into account how efficient resources are distributed among the poor (allocation efficiency)".

to exist,[83] and it may also hide inequalities between different generations living in the household (Atkinson, Cantillon, Marlier, & Nolan, 2002), leading thus to biased estimates of poverty and inequality in society (Deaton, 1997; Espinoza-Delgado & Klasen, 2018; Rodríguez, 2016). Given that the ultimate objective of poverty analysis is the welfare of individuals (Chiappori, 2016) and that poverty is a characteristic of individuals, not households (Deaton, 1997), limiting the empirical analysis to the household level "is simply unacceptable" (Chiappori, 2016, p. 840).

It is also worth noting that a gender analysis cannot be conducted by using household-based multidimensional poverty measures that are incapable of revealing gender differences within the household since they are gender-blind (Bessell, 2015; Espinoza-Delgado & Klasen, 2018; Pogge & Wisor, 2016). Gender equality, however, is an objective of global development as well (ECLAC, 2016, 2018a), as required by Goal 5 of the SDGs ("Achieve gender equality and empower all women and girls") (UN, 2015b, p. 14). Individual-based poverty measures are therefore indispensable to track progress in reaching Goals 1 (especially Target 1.2) and 5 of the SDGs.

This is why, adopting the general framework proposed by Silber and Yalonetzky (2014)[84] and Rippin's methodology (2013, 2017), we propose in this essay to use an inequality sensitive multidimensional poverty approach, with ordinal (dichotomized) variables, that overcomes the problems discussed previously.[85] The approach suggested is based on a "fuzzy" identification function that specifies explicitly the kind of relationship existing between the ordinal variables considered in the analysis, eliminating thus the ambiguity of the AF approach. The class of multidimensional poverty measures that is adopted has the advantage of taking into account efficiency and distributive justice considerations (Rippin, 2013, 2017), and it can be decomposed into the three I's of poverty, incidence, intensity, and inequality (Jenkins & Lambert, 1997). We implement such an approach by looking at poverty data in five Central American countries, namely Guatemala, El Salvador, Honduras, Nicaragua, and Costa Rica. Note that the first four countries are among the five multi-dimensionally poorest countries in Latin America and the Caribbean (Duryea & Robles, 2017; Santos & Villatoro, 2018). Our approach allows us estimating

[83] See, for instance, Asfaw, Klasen, and Lamanna (2010); Bradshaw (2002, 2013); Bradshaw, Chant, and Linneker (2017a, 2017b); Chant (2008); Klasen and Wink (2002, 2003); Rodríguez (2016).

[84] Some of the ideas raised by Silber and Yalonetzky (2014) appear already in Yalonetzky (2012, 2014).

[85] Such an approach has been used recently by Bérenger (2016, 2017).

multidimensional poverty among adults in that region, shedding some light on gender differences in multidimensional poverty and inequality, testing whether there are discrepancies between these countries regarding the impact of gender on multidimensional poverty and exploring the determinants of multidimensional poverty in Central America on the basis of logit regression models.

As far as we know, there is no study of individual-based multidimensional poverty in the literature similar to this. The rest of the essay is organized as follows. Section 2 explains the framework proposed to measure multidimensional poverty; section 3 introduces the data and justifies the dimensions, indicators, and deprivation cuttoffs, as well as the weighting structure used; section 4 discusses the main results and displays the results of the logit regression models while section 5 provides some concluding remarks.

4.2. A framework for the measurement of multidimensional poverty

4.2.1. Notations and definitions

Let $\mathbf{N} = \{1, \dots, n\} \subset \mathbb{N}$ denote the set of n individuals, and let $\mathbf{D} = \{1, \dots, d\} \subset \mathbb{N}$ represent the set of d ordinal variables measuring various aspects of individual well-being. Let $\mathbf{X} = [x_{ij}]$ be the n × d attainments matrix, where x_{ij} $(\in \mathbb{N}_{++})$ represents the attainment of the i^{th} individual for the jth variable. In this matrix, each row vector $\mathbf{x}_{i.} = (x_{i1}, \dots, x_{id})$ gives the achievements of the i^{th} individual, while each column vector $\mathbf{x}_{.j} = (x_{1j}, \dots, x_{nj})$ provides the distribution of the j^{th} variable across the population. Let $\mathbf{z} = (z_1, \dots, z_d)$ be a row vector defining the variable-specific deprivation thresholds and $\mathbf{w} = (w_1, \dots, w_d)$ the vector of variable-specific weights with $w_j > 0 \; \forall j \in [1, d]$ and $\sum_{j=1}^{d} w_j = 1$. Finally k denotes the real-valued scalar cutoff, with $0 \leq k \leq 1$. k is the minimal deprivation score an individual needs to have in order to be considered as multi-dimensionally poor ("the poverty cutoff") (Alkire & Foster, 2011, p. 478).

4.2.2. The individual multidimensional poverty function

The construction of the individual multidimensional poverty function entails two steps. The first step checks for each well-being dimension j whether the individual is deprived by comparing the individual's achievement (x_{ij}) with the deprivation threshold (z_j).

If $x_{ij} < z_j$, individual i is said to be deprived in variable j. From the **X** matrix and the **z** vector, a dichotomous deprivation matrix $\mathbf{g^0}[g_{ij}^0]$ is obtained, such that $g_{ij}^0 = 1$ if $x_{ij} < z_j$, and $g_{ij}^0 = 0$ if $x_{ij} \geq z_j$, for all $j = 1, \dots, d$ and for $i = 1, \dots, n$. A weighted deprivations score (c_i) is then computed for each individual as the weighted sum of the deprivations suffered by each of them. This score is called the "(real-valued) counting function" (Silber & Yalonetzky, 2014, p. 11) and represents the final output of the first step. Formally, the individual's counting function is defined as $c_i(x_i; z; w) = \sum_{j=1}^{d} g_{ij}^0 w_j \equiv \sum_{j=1}^{d} \mathbb{I}(x_{ij} < z_j)\, w_j$. When individual i does not suffer from any deprivation, $c_i = 0$; conversely, when the ith individual is deprived in all the variables considered in the analysis $c_i = 1$.

4.2.2.1. The identification function

The focus of the second stage of the analysis is on the identification of the multi-dimensionally poor individuals. Here the counting function c_i is compared with the poverty cutoff k. If $c_i \geq k$, then the individual i is considered as multi-dimensionally poor. The choice of k is evidently arbitrary and Alkire and Foster (2011a) propose to use an "intermediate cutoff" that lies somewhere between 0 and 1 (p. 478). Let $\psi^{AF}(x_i; z; w; k)$ be the identification function suggested by Alkire and Foster (2011a), then:

$$\psi^{AF}(x_i; z; w; k) = \begin{cases} 1 \text{ if } c_i \geq k \\ 0 \text{ if } c_i < k \end{cases} \qquad (4.a)$$

Note that ψ^{AF} is a discrete identification function; consequently, it violates the continuity axiom: a small change in c_i or in k can change from 0 to 1 or from 1 to 0 the contribution of any individual to the overall multidimensional poverty (Duclos & Tiberti, 2016). Note also that the ψ^{AF} comprises as particular cases the two conventional methods of identification introduced by Atkinson (2003) in the context of multidimensional poverty analysis: the union and the intersection approaches. Under the union approach, individuals are considered to be multi-dimensionally poor if they suffer from deprivation in at least one variable: in other words, $k \leq \min\{w_1, w_2, \dots, w_d\}$. Such an approach leads clearly to a high proportion of multi-dimensionally poor people but it has been widely adopted in the literature on multidimensional poverty (Silber & Yalonetzky, 2014). The other extreme case is that of the intersection method of identification, where individuals are identified as multi-dimensionally poor if they are deprived in each variable $(k = 1)$. This approach considers as poor only "the most indigent" individuals in the society and yields evidently the lowest

poverty rate. These two approaches to identification are extreme cases based on a strong assumption regarding the relationship between the variables (attributes). The former assumes that the variables are perfect complements while the latter supposes that the variables are perfect substitutes (Rippin, 2013, 2017).[86] This is why Alkire and Foster (2011a, p. 478) proposed an intermediate approach as "a natural alternative" to the two extreme methods of identification. However, as emphasized by Rippin (2013, 2017), the AF approach not only implies an arbitrary selection of the intermediate poverty cutoff k; it also implicitly supposes that up to k the variables are perfect substitutes while beyond k they are perfect complements, a questionable and rather hard to justify assumption.

In this essay, we prefer to adopt the "fuzzy" identification function, suggested by Rippin (2013, 2017), that makes explicit the relationship between the variables (attributes) considered in the analysis and does not introduce any kind of discontinuities when identifying the multi-dimensionally poor individuals. Let γ be an indicator of inequality aversion, a parameter describing the relationship between the attributes (Rippin, 2013, p. 27). The fuzzy identification function is then defined as

$$\psi^{\text{fuzzy}}(x_i; z; w; k) = [c_i]^{\gamma} \qquad (4.b)$$

where $[c_i]^{\gamma}$ satisfies the conditions of being non-decreasing in c_i and of having a non-decreasing (non-increasing) marginal if the variables are assumed to be substitutes (complements) (Rippin, 2013, 2017).[87]

Therefore, instead of dichotomizing the distribution of the weighted deprivations scores, as proposed by Alkire and Foster (2011a), the fuzzy identification function

[86] Here, the concepts of "substitutability" and "complementarity" follow the Auspitz-Lieben-Edgeworth-Pareto (ALEP) definition and not the well-known approach proposed by Hicks and Allen (1934a, 1934b) (Silber, 2007, p. 59). The ALEP definition considers that two attributes are substitutes (complements) if their second cross-partial derivatives are larger (less) than zero and independent if they are equal to zero (Rippin, 2013, 2017). Intuitively, on the basis of the ALEP definition, if two attributes are substitutes, poverty will decrease less with a rise in attribute 1 for individuals with larger quantities of attribute 2. The contrary is evidently true when the two attributes are supposed to be complements (Silber, 2007). For instance, assuming that income and education are substitutes, the reduction in poverty due to a unit increase in income is less important for individuals who have an educational level close to the education deprivation cutoff than for individuals with very low education. Conversely, the drop in poverty would be more substantial for individuals with a larger level of education if income and education were considered to be complements (Bourguignon & Chakravarty, 2003).

[87] "A function $f(x)$ has a non-decreasing marginal if $f(x_g + 1) - f(x_g) \geq f(x_h + 1) - f(x_h)$ whenever $x_g \geq x_h$" (Rippin, 2017, p. 61). The conditions that have to be satisfied by $[c_i]^{\gamma}$ are based on the "Theorem 1" proposed by Rippin (2013, p. 27). The proof of the Theorem can be found in Rippin (2017, p. 62-64).

distinguishes between the multi-dimensionally non-poor, on one hand, and "different degrees of poverty severity", on the other hand (Rippin, 2017, p. 42). Hence, it is considered to be fuzzy, because unless $c_i = 1$ or $c_i = 0$, each individual is "somewhat" multi-dimensionally poor (Silber & Yalonetzky, 2014, p. 13): individuals suffer different degrees of multidimensional poverty severity, depending on i) the number of variables (attributes) in which they are simultaneously deprived, and ii) the type of relationship that exists among these variables. The shape of the function depends on the value of γ. If γ is between 0 and 1, the curve describing c_i has a concave shape, while if γ is greater than 1, this curve has a convex shape. The choice between these two options depends on whether it is assumed that the variables (attributes) are substitutes or complements. If they are considered as complements, the increase in poverty severity is marginally decreasing in c_i as the loss in even one variable (attribute) can hardly be compensated (Rippin, 2013). In other words, as soon as an individual suffers from deprivation in one variable, he/she must suffer from some degree of poverty. If the variables are perfect complements, there is no compensation, and we obtain the union case; but if they are imperfect complements, we get the more general case approximated by a concave identification function. If, on the contrary, the variables are substitutes, there is compensation, and then the shortage in only one variable leads to a rather low degree of poverty severity as other variables can compensate for the deprivation. However, overall, the compensation capacity decreases as the number of deprivation increases; consequently, the poverty severity level is marginally increasing in c_i. Therefore, if they are imperfect substitutes, we obtain the more general case of a convex identification function; but, if they are perfect substitutes, there is full compensation: as long as an individual is not deprived in all variables his/her overall score will be equal to zero, which corresponds to the intersection case discussed previously.

Selecting a particular relationship between the variables is certainly not a simple task. There does not seem to be an algorithm by which we can ascertain the degree of substitutability and/or complementarity between them. It is hard to determine such degree on a pair-wise basis, a fortiori among combinations of n variables taken 3, 4, up to n at a time. Furthermore, the variables may be substitutes in the short term but complements in the long term (Thorbecke, 2008). This issue may have very significant policy implications (Silber, 2011) and it is "so conceptually important that it cannot be rationalized away" (Thorbecke, 2011, p. 486). This why in this essay, we assume different degrees of substitutability ($\gamma = 1.25, 1.50, 1.75, 2.00$) and complementarity ($\gamma = 0.25, 0.50, 0.75$) among the variables

when estimating multidimensional poverty in Central America. We then test the robustness of our conclusions to these assumptions.

4.2.2.2. The function defining the multidimensional poverty breadth

In line with the poverty measurement literature, the individual multidimensional poverty function must not only identify the multi-dimensionally poor people but also capture the intensity of the multidimensional poverty experience (Silber & Yalonetzky, 2014). However, since with ordinal (binary or dichotomized) variables the multidimensional poverty depth cannot be estimated as no poverty gap between the individual achievement in a given variable and the deprivation threshold for this variable may be calculated (Bérenger, 2017), to consider the poverty breadth we make the individual multidimensional poverty function depend on the number of deprivations. The individual multidimensional poverty function is then defined as the product of the identification function introduced previously and a function that captures the breadth of multidimensional poverty. Let $g(x_i; z; w)$ be the function that measures the multidimensional poverty breadth. The individual multidimensional poverty is then expressed as

$$p_i(x_i; z; w; k) = \psi^{Fuzzy}(x_i; z; w; k)g(x_i; z; w) \quad (4.c)$$

where $g(x_i; z; w)$ is a real-valued function that maps into the interval $[0,1]$. This function $g(x_i; z; w)$ is assumed not to rise when any achievement (e.g., x_{i1}) increases and it is strictly decreasing when a rise, $\varepsilon > 0$, in a given variable cancels the deprivation in this variable, i.e., $x_{ij} + \varepsilon > z_j > x_{ij}$ (Silber & Yalonetzky, 2014). As multidimensional poverty breadth function we adopted the one proposed by Alkire and Foster (2011a):

$$g(x_i; z; w) = c_i \quad (4.d)$$

4.2.3. The social multidimensional poverty function

In the last stage of the analysis we derive a social multidimensional poverty function by aggregating the individual multidimensional poverty functions. In the literature there are different ways of performing that aggregation, but we simply define the social multidimensional poverty function as the average of the individual poverty functions (Silber & Yalonetzky, 2014). Let $P(X; z; w; k)$ be the social multidimensional poverty function. Then

$$P(X; z; w; k) = \frac{1}{n}\sum_{i=1}^{n}\sum_{j=1}^{d} p_i(x_i; z; w; k) = \frac{1}{n}\sum_{i=1}^{n}\sum_{j=1}^{d} \psi^{Fuzzy}(x_i; z; w; k)g(x_i; z; w) \quad (4.e)$$

which leads to the "Multi-dimensional Correlation-Sensitive Class of Poverty Measures" with ordinal (dichotomized) variables proposed by Rippin (2017, p. 46)

$$P_{CS}^{\gamma} = \frac{1}{n}\sum_{i=1}^{n} c_i^{\gamma+1} \quad (4.f)$$

This class of multidimensional poverty indices satisfies the following axioms: Anonymity (AN), Monotonicity (MN), Principle of Population (PP), Strong Focus (SF), Normalization (NM), Subgroup Decomposability (SD), Factor Decomposability (FD), and Sensitivity to Inequality Increasing Switches (SIIS) (Rippin, 2013, 2017). It is the only one in the literature that satisfies not only SD and FD but also SIIS (Bérenger, 2016, 2017; Rippin, 2013, 2017).

Following Bérenger (2017, p. 148), the Multi-dimensional Correlation-Sensitive Class of Poverty Measures may be decomposed into the three I's of multidimensional poverty (Jenkins & Lambert, 1997):

$$P_{CS}^{\gamma} = HA^{\gamma+1}\left\{1 + [(\gamma+1)^2 - (\gamma+1)]\left[\frac{1}{[(\gamma+1)^2 - (\gamma+1)]}\left(\frac{1}{q}\frac{\sum_{i=1}^{q} c_i^{\gamma+1}}{A^{\gamma+1}} - 1\right)\right]\right\} \quad (4.g)$$

$$P_{CS}^{\gamma} = HA^{\gamma+1}\left\{1 + [(\gamma+1)^2 - (\gamma+1)]\, GE_{\gamma+1}(c)\right\} \quad (4.h)$$

where $H = q/n$ (the multidimensional headcount ratio) measures the incidence of multidimensional poverty, $A = \left[\sum_{i=1}^{q} c_i\right]/q$ ("the average deprivation score across the poor") (Alkire et al., 2015, p. 157) the multidimensional poverty intensity, and $GE_{\gamma+1}(c)$ ("the generalized entropy inequality index among the poor") (Bérenger, 2017, p. 148) the inequality among the multi-dimensionally poor people.

It is worth mentioning that the adjusted headcount ratio (M_0) proposed by Alkire and Foster (2011a) and adopted by the global MPI (Alkire & Santos, 2014; UNDP, 2010), and the MPI-LA (Santos & Villatoro, 2018), as well as, officially, by several countries in Central America (e.g., Honduras, El Salvador, and Costa Rica), can be computed as the product of

the incidence (H) and the intensity (A) of multidimensional poverty. As a consequence, the measure P_{CS}^{γ} can also be expressed as

$$P_{CS}^{\gamma} = M_0 A^{\gamma}\{1 + [(\gamma+1)^2 - (\gamma+1)]\, GE_{\gamma+1}(c)\} \qquad (4.i)$$

Therefore, $A^{\gamma}\{1 + [(\gamma+1)^2 - (\gamma+1)]\, GE_{\gamma+1}(c)\}$ represents substantive information that measures based on M_0 disregard. Such complementary information is particularly important in the context of the SDGs, and its targets, and for gender inequality assessments. In other words, the neglect of such information may lead to wrong conclusions concerning multidimensional poverty and its trend in a country or region, especially when inequality is an important issue.

4.3. Data sources, deprivation dimensions, indicators and cut-offs, and weighting structure

4.3.1. Data

The data used in this essay are drawn from the most recent available household surveys, in the Central American countries under scrutiny, that have been conducted by the corresponding National Institutes of Statistics. Table 4.1 shows for each country the name and the year of the survey, which is nationally representative, the sample size, and the estimated population size, computed by employing the sample weights of the survey.

In our assessment, the unit of analysis is the individual. These individuals are between 18 and 59 years old, were considered as household members and completed a full interview. The age limits selected follow the definition of children in the Convention on the Rights of the Child: “Every human being below the age of eighteen years” (UN, 1989, p. 2) and the general practice in Latin America and the Caribbean to define “older people” as those individuals aged 60 or more (Gasparini et al., 2010, p. 177). In other words in this essay, we focus on the adult members of the households, males and females, of working and reproductive ages, when “gender tensions” are the largest (ECLAC, 2016, p. 127). It is worth mentioning that in Central America, this age group represents more than 50% of the population (from a low of 47.7% in Honduras up to a maximum of 59.3% in El Salvador).

Table 4.1: Surveys used, samples size, and estimated population.

Country	Survey	Year	Sample size (individuals aged 18-59)			Estimated population (individuals aged 18-59)		
			Total	Males	Females	Total	Males	Females
Guatemala	ENCOVI	2014	26,664	12,480	14,184	7,848,739	3,665,370	4,183,369
El Salvador	EHPM	2016	40,842	18,646	22,196	3,553,224	1,613,439	1,939,785
Honduras	EPHPM	2013	15,760	7,273	8,487	4,070,318	1,891,495	2,178,824
Nicaragua	EMNV	2014	15,730	7,328	8,402	3,309,715	1,567,202	1,742,513
Costa Rica	ENAHO	2016	21,760	10,482	11,278	2,891,584	1,392,354	1,499,230
Central America	National surveys	Around 2015	120,756	56,209	64,547	21,673,580	10,129,860	11,543,721

Notes: ENCOVI: Encuesta Nacional de Condiciones de Vida (GUA-ENCOVI2014); EHPM: Encuesta de Hogares de Propósitos Múltiples (ELS-EHPM2016); EPHPM: Encuesta Permanente de Hogares de Propósitos Múltiples (HON-EPHPM2013); EMNV: Encuesta Nacional de Hogares sobre Medición de Nivel de Vida (NIC-EMNV2014); ENAHO: Encuesta Nacional de Hogares (CR-ENAHO2016).

4.3.2. Dimensions, indicators, and deprivation cut-offs

Overall, the choice of the dimensions and indicators for the individual-based multidimensional poverty index is grounded on the Sustainable Development Goals (SDGs) and targets (UN, 2015b, 2017) to be considered as a kind of normative framework with international consensus, and it is strongly conditioned by the availability of comparable (individual) data across the countries covered in our study. The five deprivation dimensions selected (education, employment, water and sanitation, energy and electricity, and the quality of the dwelling) are certainly among the most significant aspects of an individual well-being (Stiglitz et al., 2009a, 2009b). These dimensions may also be considered as "relevant for gender inequality analysis" (Robeyns, 2003, p. 76). The specific indicators chosen for each of the five dimensions and the corresponding deprivation cut-offs are presented in Table 4.2.

4.3.2.1. Education

There are quite a few reasons why education should be included in a multidimensional poverty analysis. As Drèze and Sen (2002, p. 38) observed, education can be considered to be valuable to the freedom of an individual in distinct ways, it has instrumental and intrinsic importance (Robeyns, 2006). Educational accomplishments are not only valuable achievements in themselves but also contribute, for instance, to an individual's empowerment and play a distributive role, which can help reducing "gender-based inequalities" (Drèze and Sen, 2002, p. 39). In the context of the SDGs and targets, the inclusion of education is justified by Goal 4, and its targets, that calls for ensuring "inclusive and equitable quality education and promote lifelong learning opportunities for all" (UN, 2015b, p. 17).

The ordinal educational indicator selected (schooling achievement) takes into account the information available on the schooling level attained by the individuals to assess whether they suffer from deprivation in education. We set the lower secondary school as a normative target, which is approximately equivalent to 9 years of formal schooling so that an individual who did not complete this educational level will be considered as educationally deprived. It is worth mentioning that our deprivation threshold is more demanding than the one proposed by the global-MPI ("5 years of education") (Alkire & Santos, 2010, p. 254) and the official index of Honduras, which uses "6 years of schooling" as deprivation threshold for individuals aged between 15 and 49 years of age (SCGG-INE, 2016, p. 32). It is however similar to the one required by the MPI-LA for people aged between 20 and 59 years (Santos & Villatoro, 2018, p. 59) and in tune with what is set by the official MPI of Costa Rica for people aged between 36 and 57 years (INEC-CR, 2015, p. 39) and of El Salvador for people between 18 and 64 years of age (STPP & MINEC-DIGESTYC, 2015, p. 35).

4.3.2.2. Employment

The inclusion of employment as a dimension of multidimensional poverty in Central America is based on its instrumental significance and considerable intrinsic importance (Atkinson et al., 2002; Klasen, 2000; Sen, 2000a; Stiglitz et al., 2009a, 2009b). The lack of employment (to be unemployed) involves costs for people, that go beyond the loss of income (Atkinson et al., 2002; Stiglitz et al., 2009a, 2009b). It causes deprivations of other kinds that have serious effects on individuals' lives: "psychological harm, loss of work motivation, skill and self-confidence, increase in ailments and morbidity (and even mortality rates), disruption of family relations and social life, hardening of social exclusion and accentuation of racial tensions and gender asymmetries" (Sen, 2000a, p. 94). In addition, labor market participation is considered to be "an important means of social integration" (Atkinson et al., 2002, p. 137). The SDGs and targets call for promoting "full and productive employment and decent work for all" (Goal 8) (UN, 2015b, p. 19), which is crucial in Central America countries, where the share of informal employment in total employment is estimated to be higher than 70%, with the exception of Costa Rica (ILO, 2018, p. 18).

Table 4.2: Dimensions, indicators, weights, and deprivation cut-offs.

Dimensions	Indicators	Weights (%)	Deprivation indicators: he/she is deprived if he/she…
1. Education (Goal 4 of the SDGs)	1.1. Schooling achievement	20.0	has not completed lower secondary school (9 years of schooling approximately)
2. Employment (Goal 8 of the SDGs)	2.1. Employment status	20.0	*Scenario 1* (does not consider domestic workers and unpaid care workers): is unemployed, employed without a pay, or a discouraged worker (hidden unemployment)
		20.0	*Scenario 2* (considers Scenario 1 plus domestic workers and unpaid care workers who reported that they "did not have a job" but were available to work): is unemployed, employed without a pay, or a discouraged worker (hidden unemployment)
		20.0	*Scenario 3* (considers Scenario 2 plus domestic workers and unpaid care workers who reported that they "did not have a job" but were not looking for and were not available to work because of unpaid care and/or domestic chores): is unemployed, employed without a pay, or a discouraged worker (hidden unemployment), or is unemployed, but is not looking for a job and is not available to work because of he/she has to take care of his/her children and/or a relative (s) and/or has to do domestic work
3. Water & sanitation (Goal 6 of the SDGs)	3.1. Improved water source	12.6	does not have access to an improved water source or has access to it, but out of the house and yard/plot
	3.2. Improved sanitation	7.4	only has access to an unimproved sanitation facility (a toilet or latrine without treatment or a toilet flushed without treatment to a river or a ravine) or to a shared toilet facility
4. Energy & electricity (Goal 7 of the SDGs)	4.1. Type of cooking fuel	5.4	is living in a household which uses wood and/or coal and/or dung as main cooking fuel
	4.2. Access to electricity	14.6	does not have access to electricity
5. Quality of dwelling (Goal 11 of the SDGs)	5.1. Housing materials	4.9	is living in a house with dirt floor and/or precarious roof (waste, straw, palm and similar, other precarious material) and/or precarious wall materials (waste, cardboard, tin, cane, palm, straw, other precarious material)
	5.2. People per bedroom	2.9	has to share bedroom with two or more people
	5.3. Housing tenure	7.5	is living in an illegally occupied house or in a borrowed house
	5.4. Assets	4.7	does not have access to more than one durable good of a list that includes: radio, TV, refrigerator, motorbike, car

The ordinal indicator we defined takes into account the employment status of the individual but also unpaid care work and domestic work. This is in line with target 5.4 of the SDGs: "Recognize and value unpaid care and domestic work through the provision of public services, infrastructure and social protection policies and the promotion of shared responsibility within the household and the family as nationally appropriate" (UN, 2015b, p. 18). The indicator (employment status) distinguishes two groups of individuals, among those who reported that they did not work the week preceding the survey: 1) Individuals whose main activity was to do domestic work and/or unpaid care work (hereafter unpaid care and domestic workers), and 2) individuals who were not involved in those activities. We consider three scenarios in order to shed some light on the consequences, in terms of multidimensional poverty and gender differences in poverty, of incorporating into the analysis unpaid care work and domestic work which are "commonly left out of policy agendas" (Ferrant, Pesando, & Nowacka, 2014, paragraph 1).

In the first scenario, deprivation is assumed to concern only individuals from the second group. These individuals are assumed to be deprived in employment if they are (i) unemployed (openly unemployed), (ii) employed without a pay, or (iii) discouraged workers (hidden unemployment). This first scenario considers therefore the first group as "non-deprived" in employment.

The second scenario makes the same assumption as scenario 1 for the second group. But it also includes those individuals in the first group who reported not to have a job but were available to work.

Finally, the third scenario identifies as deprived in employment the same individuals as those considered as such in the second scenario. But it also includes as deprived individuals those whose activity is unpaid care and domestic work and who reported that they were not looking for a job and were not available to work, due to the fact that they "had" to do those activities. Here we make the strong assumption that unpaid care work and domestic work are mandatory activities for the individual in the household, but that might not be true (Robeyns, 2003).

4.3.2.3. Water & sanitation

Water and sanitation are also of considerable instrumental and intrinsic importance (Klasen, 2000; Mara & Evans, 2018; Sorenson, Morssink, & Campos, 2011). An "adequate sanitation, together with good hygiene and safe water, are fundamental to good health and to social and economic development" (Mara, Lane, Scott, & Trouba, 2010, p. 1). This dimension includes two indicators, improved water source and improved sanitation, which can be assumed to be related to Goal 6 and its targets of the SDGs: "Ensure availability and sustainable management of water and sanitation for all" (UN, 2015b, p. 18). An individual is hence considered to be water deprived if he/she does not have access to drinking water in his/her house or yard/plot and he/she is deemed to be deprived in sanitation if he/she only has access to unimproved sanitation facility or to a shared toilet one. Both deprivation cut-offs are similar to the ones used by Costa Rica and El Salvador's official MPIs (INE, 2015, p. 39; STPP & MINEC-DIGESTYC, 2015, p. 36).

4.3.2.4. Energy & electricity

The dimension energy and electricity emphasizes Goal 7 of the SDGs, which demands ensuring "access to affordable, reliable, sustainable and modern energy for all" (UN, 2015b, p. 19). This dimension is measured via two indicators named type of cooking fuel and access to electricity. Both are important indicators of well-being because of their intrinsic and instrumental significance (Klasen, 2000; Santos, 2013). For instance, indoor air pollution has adverse effects on health and can increase the risk of many diseases and death (Duflo, Greenstone, & Hanna, 2008a, 2008b, 2016; Kaplan, 2010). It has also been considered to be "a global health threat, particularly for women and young children" (Duflo, et al., 2008a, p. 7). Having access to electricity, on the other hand, can help improving the living conditions of individuals by allowing them to be independent from sunlight as well as by contributing to a clean environment (Santos, 2013). Accordingly, individuals are considered to be energy deprived if they use wood and/or coal and/or dung as main cooking fuel and deprived in electricity if they do not have access to such facility.

4.3.2.5. Quality of dwelling

Finally, the individual-based multidimensional poverty index includes also a dimension that accounts for the quality of dwelling, an important well-being dimension for instrumental and intrinsic reasons (Klasen, 2000; Shaw, 2004), which occupies "a central

position in poverty research and policy" (Atkinson et al., 2002, p. 158). The dwelling quality can affect directly or indirectly the individuals' health and be an important factor (e.g., overcrowding) in the transmission of diseases (Elender, Bentham, & Langford, 1998). This dimension is included in Goal 11 of the SDGs: "Make cities and human settlements inclusive, safe, resilient and sustainable" (UN, 2015b, p. 21). To measure the quality of dwelling, we use four indicators: housing materials, people per bedroom, housing tenure, and assets; the first three indicators are used by the MPI-LA to assess the housing dimension (Santos and Villatoro, 2018, p. 59), while the fourth one is similar to the asset indicators employed by the global-MPI (Alkire & Santos, 2010, p. 254). The corresponding deprivation cut-offs are specified in Table 4.2 and are the same as those used by the indices mentioned previously.

Note that the indicators included in the last three dimensions are considered to be non-rival and non-excludable goods, that is, they are regarded as public goods, accessible equally to every individual within the household (Espinoza-Delgado & Klasen, 2018; Klasen & Lahoti, 2016; Vijaya, Lahoti, & Swaminathan, 2014).

4.3.3. Weighting structure

The selection of a weighting structure implies a "value judgment" on the tradeoffs between the dimensions (indicators) (Decancq & Lugo, 2013, p. 9). Such a weighting scheme represents another normative decision to be taken when estimating a multidimensional poverty index (Alkire et al., 2015). We opt for using a hybrid weighting scheme that combines a normative approach (among dimensions) with a data-driven one (among indicators). We attach an equal weight to each of the five dimensions (20%), but for a given dimension, following Cerioli and Zani (1990), the weight of an indicator j is defined as

$$w_j = 0.20\left(\frac{\log\frac{1}{f_j}}{\sum_{j=1}^{d}\log\frac{1}{f_j}}\right) \qquad (4.f)$$

where f_j denotes the relative frequency of individuals deprived in the jth indicator (in this dimension), considering Central America as a whole. It can be observed that the weight (w_j) assigned to an indicator for a given deprivation dimension is an inverse function of the frequency of the deprivation related to this indicator. In other words, the lower the frequency of deprivation for a given indicator, the larger the weight given to this indicator (Deutsch &

Silber, 2005). Such a weighting scheme implies therefore that deprivation is essentially a relative matter (Cerioli & Zani, 1990).

4.4. Results

4.4.1. Aggregate deprivation by indicator

Before estimating multidimensional poverty among adults in Central America, we conduct a "dashboard" approach in order to know the average degree of deprivation in the population according to the deprivation threshold defined for each of the ten indicators included in our analysis (see Table 4.2) (Ravallion, 2011, p. 236). Figure 4.1 presents, in the form of bar graphs, estimates of the percentage of adults deprived in each indicator, "the uncensored headcount ratio" (Alkire et al., 2015, p. 167), for Central America as a whole and for Guatemala, El Salvador, Honduras, Nicaragua, and Costa Rica. The confidence intervals at 95% are shown in Table 4.A.1 in Appendix 4.A. Overall, the results show that Central America still suffers substantial deprivations in several well-being indicators (e.g., education, energy, people per bedroom, and sanitation); but, at the same time, it has made good progress in reducing deprivation in some others (e.g., housing tenure and electricity).

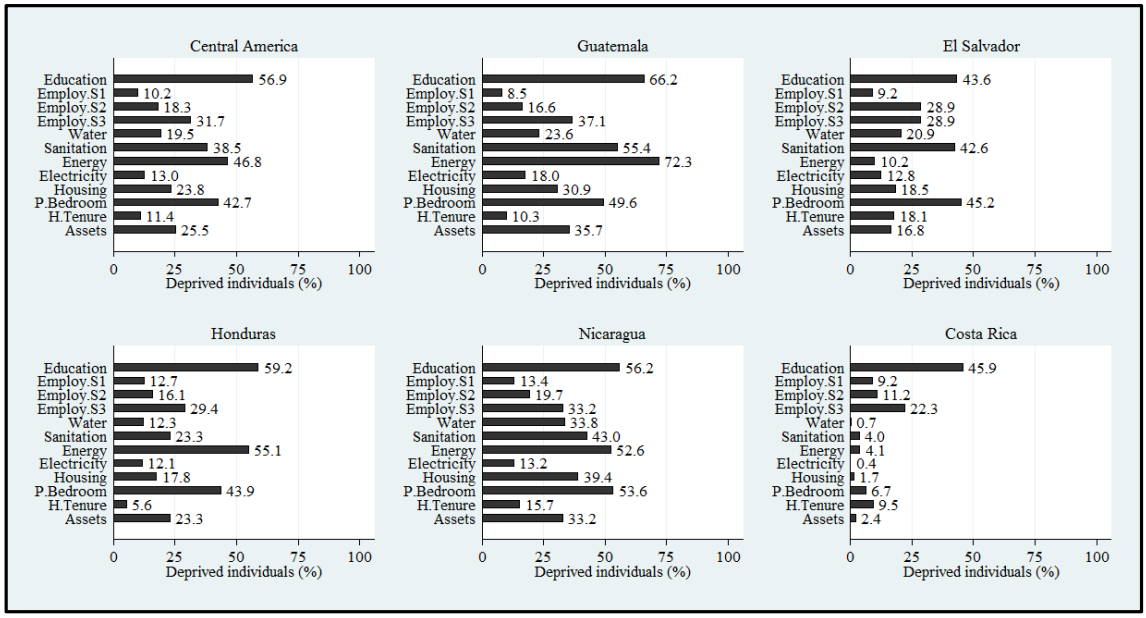

Figure 4.1: Percentage of individuals aged between 18 and 59 years deprived in several indicators.
Source: Authors' estimates based on GUA-ENCOVI2014, ELS-EHPM2016, HON-EPHPM2013, NIC-EMNV2014, and CR-ENAHO2016.
Notes: Employ.S1: employment, scenario 1; Employ.S2: employment, scenario 2; Employ.S3: employment, scenario 3. In the case of El Salvador, the survey (ELS-EHPM2016) does not provide the information needed to determine whether the individuals considered as "unpaid care and domestic workers" are available to work or are not; accordingly, the deprivation rate in employment is the same under scenarios 2 and 3 (28.9%).

Figure 4.1 reveals that education is the biggest challenge for Central America. Almost six in ten Central American adults have not yet achieved the lower secondary school level (approximately 9 years of schooling), which limits dramatically their possibilities to get better jobs and have better lives (ECLAC, 2015, 2016, 2018a, 2018b) and, overall, affects negatively their individual and communal empowerment (Trommlerová, Klasen, & Leßmann, 2015). The second major challenge for the region is to continue fostering the use of clean energy for cooking. This is so because approximately five out of ten Central American adults remain directly or indirectly exposed to indoor air pollution from cooking fuels, that may induce respiratory problems and eventually chronic illnesses, if not death (Duflo et al., 2008a, 2008b, 2016; Gall, Carter, Earnest, & Stephens, 2013; ECLAC, 2017). According to Figure 4.1, the next challenges for the region are to reduce overcrowding in the home, as it is estimated that more than four in ten Central Americans aged between 18 and 59 years (approx. 9.3 million people) share the bedroom with two or more people, and to increase the provision of improved sanitation facilities. Four out of ten adults do not have access to such facilities, and if they have, they share them with people who belong to another household. Note that Figure 4.1 shows that deprivation in employment ranges from 10.2% (employment S1, first scenario) to 31.7% (employment S3, third scenario), which means that in Central America, the percentage of adults who "do not have a paid job" but are involved in unpaid care work and/or domestic work is estimated to be 21.5% (approximately 4.7 million people).

Looking at country specific results, we observe that Guatemala, Honduras, and Nicaragua are the countries with the highest deprivation rates (above 55%) in education. These findings are consistent with the recent work by Duryea and Robles (2017). They suggested (p. 20), on the base of the microdata of the 2012 and 2014 Latinobarómetro (LAPOP), that, as far as people aged between 25 and 65 years are concerned, these countries have the lowest average number of years of schooling (below 7.5 years) in Central America and, even, in Latin America and the Caribbean. Guatemala exhibits, on the other hand, the largest percentage of adults not having a paid job but doing unpaid care work and/or domestic work (28.6%), followed by El Salvador and Nicaragua (19.7%). Concerning the other dimensions and the corresponding indicators, excluding the case of housing tenure, Guatemala (for sanitation, energy, electricity, and assets) and Nicaragua (for water, housing, and people per bedroom) have the greatest deprivation rates while Costa Rica has the lowest ones. Note that Costa Rica is close to eliminating deprivation in water, electricity, housing,

and assets. One may then argue that for this country, a relative, rather than an absolute, approach to defining deprivation would be more relevant.

4.4.2. Estimating multidimensional poverty among adults

We firstly illustrate empirically how the fuzzy identification function described in Section 4.2 performs, considering Central America as a whole and only the first deprivation cutoff for employment (the first scenario). Figure 4.2 draws such function assuming different levels of "inequality aversion" (Rippin, 2013, p. 28), that is, using diverse values of γ: from 0.05 to 10.0. The solid curves both at the top and at the bottom of the figure approximate the cases in which the attributes are supposed to be perfect complements ($\gamma = 0.05$) and perfect substitutes ($\gamma = 10.00$), respectively; the solid line in the middle (the 45^{o} degree line) assumes, in turn, that the attributes are independent ($\gamma = 1.00$).

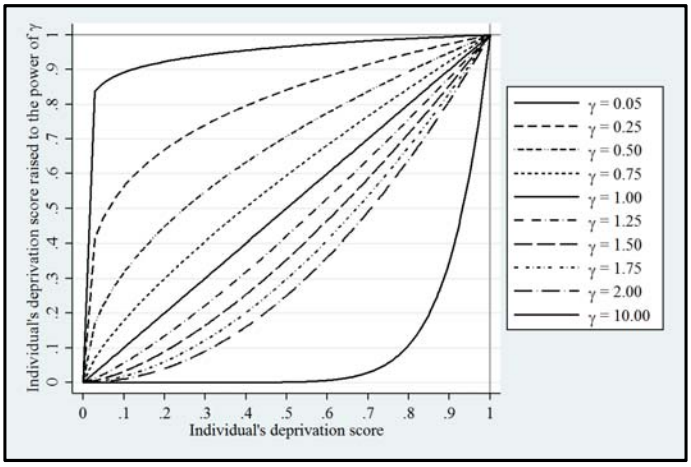

Figure 4.2: Fuzzy identification function for several values of **γ**.
Source: Authors' estimates based on GUA-ENCOVI2014, ELS-EHPM2016, HON-EPHPM2013, NIC-EMNV2014, and CR-ENAHO2016.

Figure 4.2 makes clear that the marginal increase in an individual's poverty severity is larger, the lower the substitutability between indicators (moving from $\gamma = 10.00$ to $\gamma = 0.05$), and that an individual's poverty level is higher, the harder the compensation of deprivation in one attribute. The degree of poverty of individuals depends thus not only on their weighted deprivation scores but also on the way in which these deprivations are correlated (Rippin, 2013, 2017). This is an important issue that has been overlooked by the vast majority of empirical works concerned with multidimensional poverty analysis, despite the fact that "it may have very important policy implications" (Silber, 2011, p. 479). As a result, multidimensional poverty in society as a whole depends also on the degree of

inequality aversion adopted and its estimate is sensitive to such an assumption. Therefore, since we do not know any algorithm through which we can accurately determine the degree of "inequality aversion", we propose, in this essay, to use a battery of measures to assess multidimensional poverty, as opposed to employing a specific one.

The overall estimates of multidimensional poverty among adults in Central America as a region, as well as in Guatemala, El Salvador, Honduras, Nicaragua, and Costa Rica, considering the three scenarios discussed in Table 4.2 (three deprivation cutoffs for employment) and several values of γ, are displayed graphically in Figure 4.3. The point estimates and their bootstrapped confidence intervals at 95% are presented in Table 4.A.2 in Appendix 4.A.

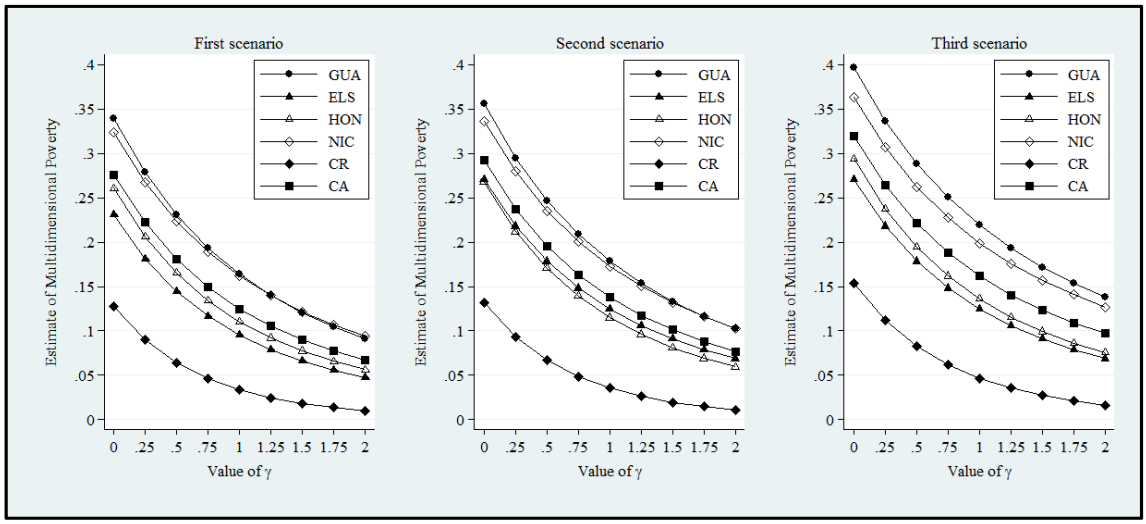

Figure 4.3: Estimates of overall multidimensional poverty in Central America (CA) as a whole and in Guatemala (GUA), El Salvador (ELS), Honduras (HON), Nicaragua (NIC), and Costa Rica (CR), considering three scenarios and several degrees of inequality aversion (**γ**).
Source: Authors' estimates based on GUA-ENCOVI2014, ELS-EHPM2016, HON-EPHPM2013, NIC-EMNV2014, and CR-ENAHO2016.
Note: In the case of El Salvador, the multidimensional poverty estimates corresponding to the second and third scenarios are the same, as the deprivation rates in employment are identical. This is because the survey (ELS-EHPM2016) does not provide the information needed to determine whether the individuals considered as "unpaid care and domestic workers" were available to work or were not (see Table 4.2).

Figure 4.3 shows that, regardless of the scenario adopted, multidimensional poverty among adults in Central America, as well as in the countries included in the analysis, decreases as γ increases: the estimated multidimensional poverty is lower, the higher the degree of inequality aversion (or substitutability among the indicators) (Rippin, 2013, 2017). This is in line with our previous discussion. The largest estimates of multidimensional poverty are obtained when the indicators are assumed to be perfect complements ($\gamma = 0$), that

is, when a union approach is applied to identify the multi-dimensionally poor adults. In this particular case, our estimates are identical to those obtained when using the adjusted headcount ratio (M_0 index) proposed by Alkire and Foster (2011a) (see Section 4.2). Note also that each of the resulting curves moves upwards as the threshold used to determine deprivation in employment becomes more demanding (from the first scenario to the third one). In other words multidimensional poverty rises when including unpaid care work and domestic work into the analysis.

Figure 4.3 also suggests that multidimensional poverty among adults is highest in Guatemala, followed by Nicaragua, except under the first scenario when γ takes a value of 1.50, 1.75, and 2.00 (notice in Figure 4.3 that Guatemala's curve intersect that of Nicaragua from above; see also Table 4.A.2 in Appendix 4.A), and, by contrast, it is the lowest in Costa Rica. Honduras and El Salvador appear in the middle but below the regional averages (CA curve). Note also that under the third scenario, the differences in multidimensional poverty between Guatemala and Nicaragua become more substantial than the ones observed under the other scenarios, because Guatemala has a larger percentage of unemployed adults who do unpaid care work and/or domestic work than Nicaragua. In general, the resulting multidimensional poverty ranking is quite similar to the one suggested by recent empirical evidence on Latin America and the Caribbean region, which is grounded on household-based measures (see, e.g., Santos & Villatoro, 2018, p. 75; Duryea & Robles, 2017, p. 165); therefore, it seems to be a robust finding.

To obtain a more revealing picture of the estimated multidimensional poverty among adults and its distribution that considers also Goal 10 of the SDGs ("Reduce inequality within and among countries") (UN, 2015b, p. 21), we computed the average multidimensional poverty of adults in each percentile. We then ranked these adults by decreasing values of their individual multidimensional poverty function, and drew a curve on the base of these 100 "observations". We followed here the idea of the three "I"s of poverty curve proposed by Jenkins and Lambert (1997). Figures 4.4, 4.5, and 4.6 show the resulting curves for Central America as a whole, as well as for Guatemala, El Salvador, Honduras, Nicaragua, and Costa Rica, considering three representative levels of "inequality aversion" (0.50, 1.00, and 1.50) and the three scenarios under analysis.[88] For each curve, the overall estimated

[88] Under each scenario, the pattern of the curves considering the other levels of inequality aversion (0.25, 0.75, 1.25, 1.75, and 2.00) is similar; such curves are available upon request.

multidimensional poverty among adults is given by the height of the curve (the vertical intercept at the 100th percentile). The multidimensional poverty incidence is that percentile at which the curve becomes horizontal, in other words, it is summarized by the length of the non-horizontal section of the curve; and the inequality among the multi-dimensionally poor adults is approximated by the concavity degree of the non-horizontal section of the curve. As far as the inequality is concerned, it is worthy of note that since we computed the average multidimensional poverty of adults in each percentile, by definition, the resulting curves are also a function of the generalized entropy inequality index among the poor (see equations 4.g and 4.h); however, due to the fact that the centiles were ranked by increasing values of the values of the multidimensional poverty index, the curve drawn takes into account the between centiles inequality in deprivation as the within centiles inequality is taken into account by the average value of the multidimensional poverty index of the centile.

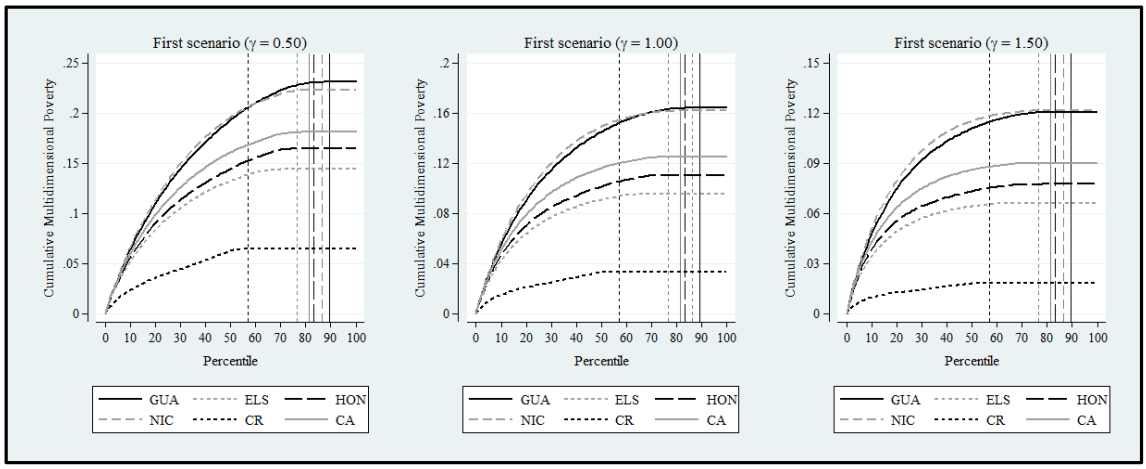

Figure 4.4: Cumulative multidimensional poverty among adults by population percentile, ordered from the poorest to the richest, in Central America as a whole and in Guatemala (GUA), El Salvador (ELS), Honduras (HON), Nicaragua (NIC), and Costa Rica (CR).
Source: Authors' estimates based on GUA-ENCOVI2014, ELS-EHPM2016, HON-EPHPM2013, NIC-EMNV2014, and CR-ENAHO2016.
Notes: In each case, the overall estimated multidimensional poverty (see Table 4.A.2 in Appendix 4.A) corresponds to the height of the curve: the vertical intercept at 100th percentile. The incidence of multidimensional poverty (the headcount ratio or the proportion of multi-dimensionally poor people) corresponds to the length of the non-horizontal section of the curve, that is, the percentile at which the curve becomes horizontal. For each country, we drew a vertical line at such a percentile (headcount ratio). The average multidimensional poverty among the poor is equal to the slope of the ray from (0, 0) to the point at which the vertical line intercept the curve. Inequality among the multi-dimensionally poor individuals is approximated by the degree of concavity of the non-horizontal section of the curve (Jenkins & Lambert, 1997).

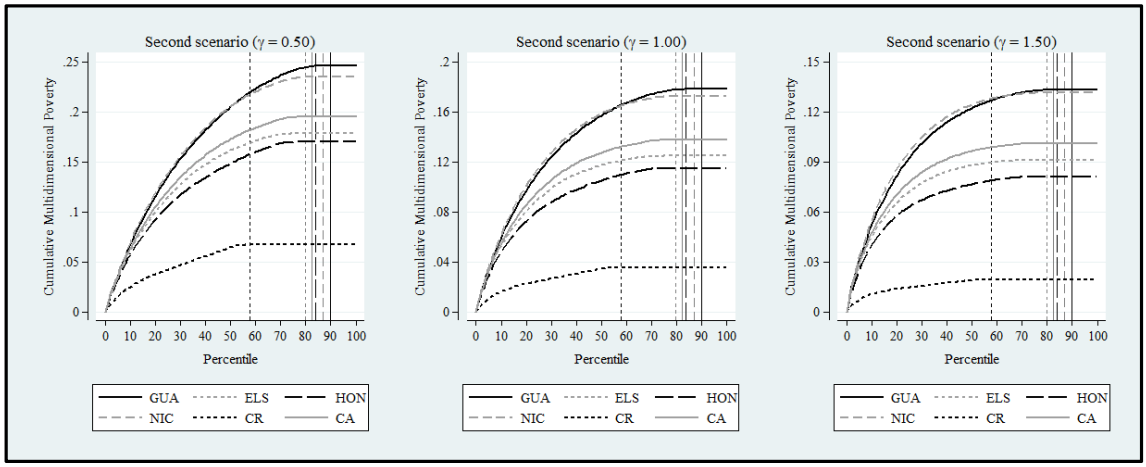

Figure 4.5: Cumulative multidimensional poverty among adults by population percentile, ordered from the poorest to the richest, in Central America as a whole and in Guatemala (GUA), El Salvador (ELS), Honduras (HON), Nicaragua (NIC), and Costa Rica (CR).
Source: Authors' estimates based on GUA-ENCOVI2014, ELS-EHPM2016, HON-EPHPM2013, NIC-EMNV2014, and CR-ENAHO2016.
Notes: In each case, the overall estimated multidimensional poverty (see Table 4.A.2 in Appendix 4.A) corresponds to the height of the curve: the vertical intercept at 100th percentile. The incidence of multidimensional poverty (the headcount ratio or the proportion of multi-dimensionally poor people) corresponds to the length of the non-horizontal section of the curve, that is, the percentile at which the curve becomes horizontal. For each country, we drew a vertical line at such a percentile (headcount ratio). The average multidimensional poverty among the poor is equal to the slope of the ray from (0, 0) to the point at which the vertical line intercept the curve. Inequality among the multi-dimensionally poor individuals is approximated by the degree of concavity of the non-horizontal section of the curve (Jenkins & Lambert, 1997).

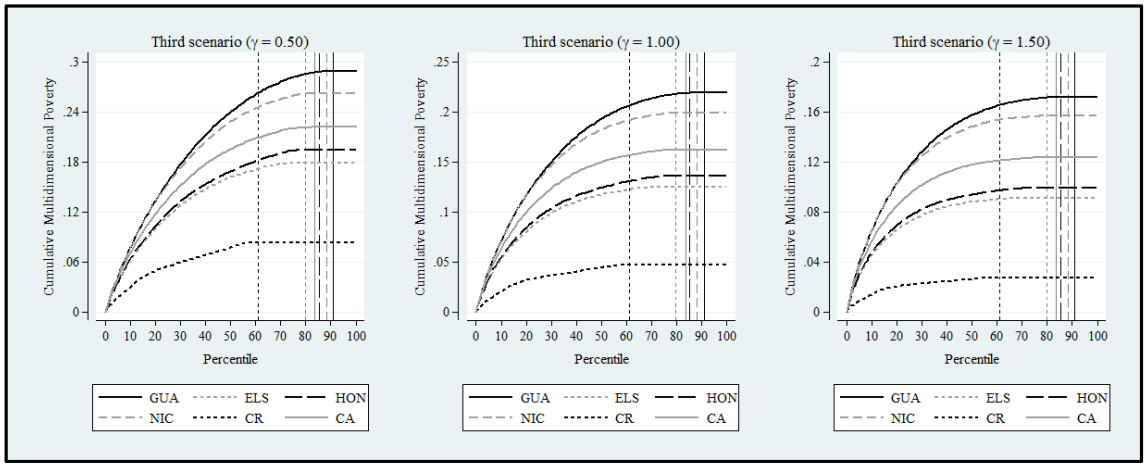

Figure 4.6: Cumulative multidimensional poverty among adults by population percentile, ordered from the poorest to the richest, in Central America as a whole and in Guatemala (GUA), El Salvador (ELS), Honduras (HON), Nicaragua (NIC), and Costa Rica (CR).
Source: Authors' estimates based on GUA-ENCOVI2014, ELS-EHPM2016, HON-EPHPM2013, NIC-EMNV2014, and CR-ENAHO2016.
Notes: In each case, the overall estimated multidimensional poverty (see Table 4.A.2 in Appendix 4.A) corresponds to the height of the curve: the vertical intercept at 100th percentile. The incidence of multidimensional poverty (the headcount ratio or the proportion of multi-dimensionally poor people) corresponds to the length of the non-horizontal section of the curve, that is, the percentile at which the curve becomes horizontal. For each country, we drew a vertical line at such a percentile (headcount ratio). The average multidimensional poverty among the poor is equal to the slope of the ray from (0, 0) to the point at which the vertical line intercept the curve. Inequality among the multi-dimensionally poor individuals is approximated by the degree of concavity of the non-horizontal section of the curve (Jenkins & Lambert, 1997).

Figures 4.4, 4.5, and 4.6 allow us to conclude unambiguously that whatever the percentile considered, multidimensional poverty among adults is always, by far, lower in Costa Rica than in the "Northern Square" of Central America (Guatemala, El Salvador, Honduras, and Nicaragua); and, conversely, it is always larger in Guatemala and Nicaragua. Note that although multidimensional poverty is, as a whole, higher in Guatemala than in Nicaragua, it is not higher among Guatemalan adults up to approximately the 50th percentile, considering both the first and the second scenarios, and up to around the 20th percentile, considering the third scenario. These findings suggest that multidimensional poverty among adults is more unequally distributed in Nicaragua than in Guatemala. Therefore, based on such findings, we can conclude that in the Central American region, the poorest adults of the poorest ones live in Nicaragua.

Figures 4.4, 4.5, and 4.6 show also that Guatemala is the country with the highest incidence of multidimensional poverty in Central America, followed by Nicaragua, Honduras, El Salvador, and Costa Rica, respectively. The point estimates of the incidence of multidimensional poverty, as well as their bootstrapped confidence intervals at 95%, are given in Table 4.A.3 in Appendix 4.A. Such a table suggests that in Central America, on average, the multidimensional poverty incidence among adults increases by 3% as a result of incorporating unpaid care and domestic work into the assessment. Table 4.A.3 gives also the estimates of the intensity of multidimensional poverty among adults in Guatemala, El Salvador, Honduras, Nicaragua, and Costa Rica, as well as in Central America as a whole, considering the three scenarios under study (S1, S2, and S3). Table 4.A.3 reveals that the average deprivation share (A) experienced by the multi-dimensionally poor adults in Central America is larger in countries with higher multidimensional poverty rates (Guatemala and Nicaragua). This is consistent with the international evidence (see, e.g., Alkire & Santos, 2014; Santos & Villatoro, 2018). Overall, the average deprivation share (A) exceeds 30%, which means that, on average, the multi-dimensionally poor adults in Central America are deprived in more than three indicators. Finally, Table 4.A.3 shows that in Central America, the overall impact on the intensity of multidimensional poverty, of considering unpaid care workers and domestic workers as employment deprived, is estimated to be 12%.

As discussed in Section 4.2, the multidimensional poverty measures used in this essay are sensitive to inequality among the multi-dimensionally poor adults and can be decomposed into the three I's of multidimensional poverty (incidence, intensity, and

inequality) (Jenkins & Lambert, 1997). Therefore, to complement the previous results, Figure 4.7 presents graphically estimates of the inequality among poor adults, measured via the Generalized Entropy Inequality Index. This is done for each of the countries and for Central America as a whole, for each of the three scenarios and for several levels of inequality aversion. Point estimates and their bootstrapped confidence intervals at 95% are given in Table 4.A.4 in Appendix 4.A.

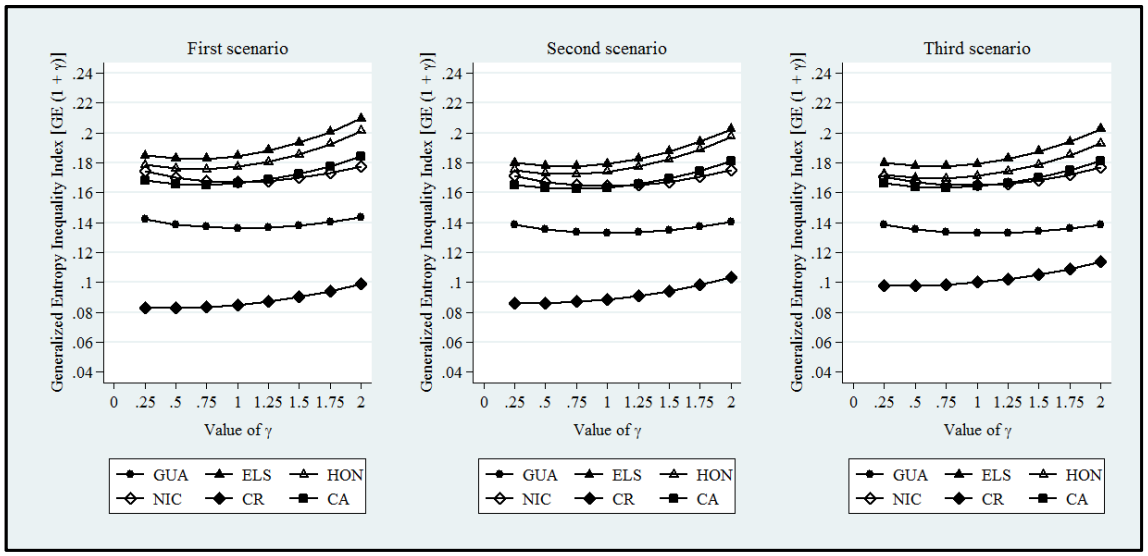

Figure 4.7: Inequality among the multi-dimensionally poor adults in Guatemala (GUA), El Salvador (ELS), Honduras (HON), Nicaragua (NIC), and Costa Rica (CR), as well as in Central America (CA) as a whole, considering three scenarios and several levels of inequality aversion (values of γ).
Source: Authors' estimates based on GUA-ENCOVI2014, ELS-EHPM2016, HON-EPHPM2013, NIC-EMNV2014, and CR-ENAHO2016.
Note: In the case of El Salvador, the inequality among the multi-dimensionally poor adults, corresponding to the second and the third scenario, is the same. This is so because the deprivation rates in employment are identical, given that the survey (ELS-EHPM2016) does not provide the information needed to determine whether the adults considered as "unpaid care and domestic workers" were available for work or not (see Table 4.2).

Figure 4.7 is interesting. It shows clearly that in the Central American region, El Salvador and Honduras have the largest inequality among the multi-dimensionally poor adults. These two countries however do not have the highest levels of multidimensional poverty, nor the highest incidence and intensity of multidimensional poverty in that region. Such an observation indicates that the distribution of the deprivation scores of the adults in these two countries is more unequal than that in Nicaragua, Guatemala, and Costa Rica. In other words, El Salvador and of Honduras have a larger percentage of multi-dimensionally poor adults who have large deprivations than the one observed in Nicaragua, Guatemala, and Costa Rica. Given that the official multidimensional poverty measure of El Salvador and of Honduras is insensitive to inequality among the multi-dimensionally poor, it does not capture

the feature that was just mentioned. Needless to say, such an omission may lead to wrong poverty alleviation policies and programs. Figure 4.7 makes it also clear that this inequality is larger in Nicaragua than in Guatemala, confirming thus previous findings obtained on the base of Figures 4.4, 4.5, and 4.6, and lowest in Costa Rica.

4.4.3. Shedding some light on gender gaps in multidimensional poverty in Central America

Table 4.3 shows the ratio of women's multidimensional poverty estimates to men's multidimensional poverty estimates in Guatemala, El Salvador, Honduras, Nicaragua, and Costa Rica, as well as in Central America as a whole, considering the three scenarios and several degrees of inequality aversion. Tables 4.A.5, 4.A.6, 4.A.7, and 4.A.8 in Appendix 4.A give the corresponding estimates of multidimensional poverty among adults by gender and their bootstrapped standard errors, as well as the absolute gender differences in multidimensional poverty and their statistical significance. In general, we find that there are statistically significant gender gaps in multidimensional poverty among adults in the countries under analysis, but, as expected, the size and the direction of such gaps depend on the deprivation threshold used for employment and, therefore, on the information incorporated into the analysis (the scenarios).

Table 4.3 shows that overall, the size of the gender gaps in multidimensional poverty becomes larger as the degree of inequality aversion rises: the greater the value of γ, the larger the size of the gender gap. We will analyze below what drives such gaps (incidence, intensity, or inequality). Meanwhile, note that when $\gamma = 0$ (second column of Table 4.3), the multidimensional poverty index P_{CS}^{γ}, defined previously, is equal to HA. Therefore the ratio $\left(P_{CS}^{\gamma}/P_{CS}^{0}\right)$ is equal to product of the multidimensional poverty intensity (A) raised to the power γ (that is, A^{γ}) and the inequality component $\{1 + [(\gamma+1)^2 - (\gamma+1)]GE_{\gamma+1}(c)\}$ [see equation (4.i) in Section 4.2]. Such a ratio estimates therefore what the AF measure M_o (with $M_0 = H * A$) overlooks.

Table 4.3: Ratio of women's multidimensional poverty estimates to men's multidimensional poverty estimates in Guatemala (GUA), El Salvador (ELS), Honduras (HON), Nicaragua (NIC), and Costa Rica (CR), as well as in Central America as a whole, considering three scenarios and several degrees of inequality aversion.
Source: Authors' estimates based on GUA-ENCOVI2014, ELS-EHPM2016, HON-EPHPM2013, NIC-EMNV2014, and CR-ENAHO2016.

Panel I: Scenario 1

Country	Value of γ								
	0.00	**0.25**	**0.50**	**0.75**	**1.00**	**1.25**	**1.50**	**1.75**	**2.00**
GUA	0.98	0.97	0.95	0.94	0.93	0.91	0.90	0.89	0.88
ELS	0.97	0.95	0.94	0.93	0.92	0.91	0.89	0.88	0.87
HON	0.87	0.84	0.82	0.80	0.78	0.75	0.74	0.72	0.70
NIC	0.90	0.89	0.88	0.87	0.87	0.86	0.86	0.85	0.85
CR	0.98	0.99	0.99	0.99	1.00	1.00	1.01	1.01	1.01
CA	0.94	0.93	0.92	0.91	0.89	0.88	0.87	0.86	0.84

Panel II: Scenario 2

Country	Value of γ								
	0.00	**0.25**	**0.50**	**0.75**	**1.00**	**1.25**	**1.50**	**1.75**	**2.00**
GUA	1.06	1.06	1.07	1.07	1.07	1.08	1.08	1.08	1.08
ELS	1.27	1.31	1.36	1.40	1.45	1.49	1.54	1.59	1.63
HON	0.90	0.88	0.86	0.85	0.83	0.82	0.80	0.79	0.77
NIC	0.97	0.97	0.97	0.98	0.98	0.99	1.00	1.01	1.02
CR	1.04	1.05	1.07	1.08	1.10	1.12	1.14	1.15	1.17
CA	1.04	1.05	1.05	1.06	1.06	1.07	1.07	1.08	1.08

Panel III: Scenario 3

Country	Value of γ								
	0.00	**0.25**	**0.50**	**0.75**	**1.00**	**1.25**	**1.50**	**1.75**	**2.00**
GUA	1.27	1.33	1.39	1.45	1.50	1.56	1.62	1.68	1.74
ELS	1.27	1.31	1.36	1.40	1.45	1.49	1.54	1.59	1.63
HON	1.07	1.08	1.10	1.12	1.13	1.15	1.17	1.19	1.21
NIC	1.12	1.15	1.19	1.22	1.27	1.31	1.36	1.41	1.46
CR	1.36	1.44	1.53	1.62	1.72	1.83	1.93	2.04	2.15
CA	1.21	1.26	1.30	1.35	1.39	1.44	1.49	1.54	1.59

Notes: Survey weights used; a ratio greater than one means that multidimensional poverty is larger among adult women than among adult men. In the case of El Salvador, the ratios corresponding to the second and third scenarios are the same because the deprivation rates in employment are identical in both cases (the survey (ELS-EHPM2016) does not provide the information needed to determine whether the adults considered as "unpaid care and domestic workers" were available to work or were not) (see Table 4.2).

Our "artificial" base scenario, the one that does not consider unpaid care workers and domestic workers (scenario 1, Panel I of Table 4.3) suggests that multidimensional poverty among adults in Guatemala, El Salvador, Honduras, and Nicaragua is more often poverty among males, while in Costa Rica multidimensional poverty seems to be gender neutral.. The results of the more relevant second scenario, however, do not, as expected, confirm such conclusions (Panel 2 of Table 4.3). Assuming that unpaid care and domestic workers who reported "not having a job" but "were available to work" are also employment deprived, raises substantially female multidimensional poverty, while male poverty remains almost unchanged (see Tables 4.A.5 and 4.A.6 in Appendix 4.A). This is particularly true for Guatemala, El Salvador, and Costa Rica, where the ratio of female over male multidimensional poverty increases significantly (above 5%), as can be observed by comparing Scenarios 1 and 2 in Table 4.3. Multi-dimensional poverty in these countries is

now unambiguously female poverty. Note also that in these countries, multidimensional poverty is higher among women in every percentile of the distribution (see Figures 4.A.1, 4.A.2, and 4.A.3 in Appendix 4.A). We also observe in Scenario 2 of Table 4.3 that Honduras is the only country in Central America where multidimensional poverty among adults is not female poverty (see also Figure 4.A.4. in Appendix 4.A). Nicaragua, on the other hand, has the smallest gender gaps: multidimensional poverty as a whole seems now to be gender-neutral, although it is higher among women up to around the 20th poorest percentile (see Figure 4.A.5. in Appendix 4.A). This clearly indicates that multidimensional poverty among women is not equally distributed in this country. For Central America as a whole multidimensional poverty is feminized, but gender-neutral for around the first 20 poorest percentiles (see Figure 4.A.6. in Appendix 4.A).

Finally, as expected, the results for the third scenario (Panel 3 of Table 4.3) reinforce the previous findings. The gender gaps become much more substantial, revealing unambiguously that in Central America, adult women are more likely than adult men to be multi-dimensionally poor.

Table 4.3 therefore confirms that unpaid care work and/or domestic work in Central America has a much larger negative impact on women's well-being than on that of men. Nevertheless, the observed estimated gaps should be interpreted with some caution. First, the third scenario is based on the strong assumption that unpaid care work and domestic work are "mandatory" activities and "have to be done for extended periods" (Robeyns, 2003, p. 80). The gender gaps observed in each country may therefore be overstated. Second, since not all surveys have a time use module, we consider as non-deprived in employment those individuals that have a paid work as well as an unpaid care work and/or a domestic work. Such an assumption is likely to underestimate female deprivation levels and, as a consequence, gender gaps (see, e.g., Bradshaw et al., 2017b).

We have also decomposed multidimensional poverty among adult women and men into the three I's of multidimensional poverty in order to find out what drives the gender gaps observed in Table 4.3: the incidence, the intensity, or the inequality of poverty. Table 4.4 displays the gender differences, in relative terms, in the incidence, intensity, and inequality component of multidimensional poverty in Guatemala, El Salvador, Honduras, Nicaragua, Costa Rica, and Central America as a whole, considering the three scenarios and several degrees of inequality aversion. Tables 4.A.9, 4.A.10, and 4.A.11 in Appendix 4.A show the

estimates by gender of such "dimensions" of multidimensional poverty (Jenkins and Lambert, 1997, p. 317), as well as the corresponding gender gaps in absolute and relative terms and their statistical significance.

Table 4.4: Gender gaps in relative terms in the three I's of multidimensional poverty (ratio of women's to men's) in Guatemala (GUA), El Salvador (ELS), Honduras (HON), Nicaragua (NIC), and Costa Rica (CR), as well as in Central America as a whole, considering three scenarios and several degrees of inequality aversion.
Source: Authors' estimates based on GUA-ENCOVI2014, ELS-EHPM2016, HON-EPHPM2013, NIC-EMNV2014, and CR-ENAHO2016.

Panel I: Scenario 1

Country	Incidence (H)	Intensity (A)	Inequality component: $\{1+[(\gamma+1)^2-(\gamma+1)]GE_{\gamma+1}(c)\}$ (several values of γ)								
			0.00	0.25	0.50	0.75	1.00	1.25	1.50	1.75	2.00
GUA	1.01	0.97	1.00	1.00	0.99	0.99	0.98	0.97	0.97	0.96	0.95
ELS	0.99	0.97	1.00	1.00	0.99	0.98	0.98	0.97	0.97	0.96	0.96
HON	0.97	0.89	1.00	1.00	1.00	1.00	1.00	1.01	1.01	1.01	1.01
NIC	0.97	0.93	1.00	1.01	1.01	1.02	1.03	1.05	1.06	1.07	1.09
CR	0.98	1.00	1.00	1.00	1.01	1.01	1.01	1.02	1.02	1.02	1.03
CA	0.99	0.95	1.00	1.00	1.00	1.00	0.99	0.99	0.99	0.99	0.99

Panel II: Scenario 2

Country	Incidence (H)	Intensity (A)	Inequality component: $\{1+[(\gamma+1)^2-(\gamma+1)]GE_{\gamma+1}(c)\}$ (several values of γ)								
			0.00	0.25	0.50	0.75	1.00	1.25	1.50	1.75	2.00
GUA	1.02	1.04	1.00	0.99	0.99	0.98	0.98	0.97	0.96	0.95	0.95
ELS	1.07	1.19	1.00	0.99	0.98	0.97	0.96	0.95	0.94	0.92	0.91
HON	0.98	0.92	1.00	1.00	1.00	1.00	1.00	1.00	1.01	1.01	1.01
NIC	0.98	0.99	1.00	1.00	1.01	1.02	1.03	1.04	1.05	1.06	1.08
CR	1.00	1.04	1.00	1.00	1.01	1.02	1.02	1.03	1.04	1.04	1.05
CA	1.01	1.03	1.00	1.00	1.00	0.99	0.99	0.99	0.98	0.98	0.98

Panel III: Scenario 3

Country	Incidence (H)	Intensity (A)	Inequality component: $\{1+[(\gamma+1)^2-(\gamma+1)]GE_{\gamma+1}(c)\}$ (several values of γ)								
			0.00	0.25	0.50	0.75	1.00	1.25	1.50	1.75	2.00
GUA	1.04	1.23	1.00	0.99	0.99	0.98	0.96	0.95	0.94	0.93	0.91
ELS	1.07	1.19	1.00	0.99	0.98	0.97	0.96	0.95	0.94	0.92	0.91
HON	1.00	1.07	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
NIC	1.01	1.11	1.00	1.00	1.01	1.02	1.02	1.03	1.04	1.05	1.06
CR	1.11	1.23	1.00	1.01	1.01	1.02	1.03	1.04	1.05	1.05	1.05
CA	1.04	1.17	1.00	1.00	0.99	0.99	0.98	0.98	0.97	0.97	0.96

Notes: Survey weights used; a ratio greater than one means that the incidence (the intensity or the inequality component) of multidimensional poverty is larger among women than among men. For El Salvador, the ratios corresponding to the second and the third scenario are identical because the deprivation rates in employment are the same. The reason is that the survey (ELS-EHPM2016) does not provide the information needed to determine whether the adults considered as "unpaid care and domestic workers" were available to work or were not (see Table 2). Each ratio in Table 4.3 can be computed as follows: $\text{ratio(H)} * \text{ratio(A)} * [\text{ratio(A)}]^{\gamma} * \text{ ratio(inequality\_component)}$.

Table 4.4 suggests that both the incidence and the intensity of multidimensional poverty increase more among women than among men when unpaid care work and domestic work are taken into account. It appears, however, that the increase in the gender gap is higher for multidimensional poverty intensity than incidence. Nevertheless, the changes in these two poverty dimensions are not uniform across countries. In Guatemala, El Salvador, and Costa

Rica the incidence of multidimensional poverty is higher among women than men while in Honduras and Nicaragua, it seems to be gender-neutral. Similar observations may be made for the intensity of multidimensional poverty in Guatemala, El Salvador, and Costa Rica, particularly under the second and the third scenario. But, the results for Nicaragua and Honduras are somewhat ambiguous, whatever scenario is considered. As far as the inequality component is concerned, it is clear that it is higher among women in Nicaragua and Costa Rica, implying that in those countries, the severity of multi-dimensionally poverty among females is much higher than that among males, the reverse being true for Guatemala and El Salvador. In Honduras, the inequality component seems to be gender-neutral.

For Central America as a whole, Table 4.4 shows that the gender gaps in the incidence and intensity of multidimensional poverty among adults is lower than 5%, except for the intensity of poverty under the third scenario (17%). We also observe that the inequality component is more important among men than women.

4.4.4. Results of logit regression models

The descriptive results presented previously show that, in Central America, there are differences between the countries with respect to the size and direction of the gender gaps in multidimensional poverty. We now turn to a more econometric analysis. Following Wiepking and Mass (2005, p. 193), we estimate two logit regressions, for Central America as a whole, where the endogenous variable is equal to 1 if the individual is multi-dimensionally poor, to 0 otherwise, and take into account the three scenarios mentioned previously.

In the first model (M1) the explanatory variables are the sex of the individual (dummy variable equal to 1 for females) and country fixed effects, Costa Rica being the country of reference. In the second model (M2) we add a set of interaction terms between the sex and the country.

The results are presented in Table 4.5, separately for each of the three scenarios. They corroborate the main findings of the descriptive analysis. Adults living in Guatemala have the highest probability of being multi-dimensionally poor, followed by those of Nicaragua, while the lowest probability is observed for adults living in Costa Rica. Model M2 seems to slightly better fit the dataset (higher Wald χ square and Pseudo R-square), suggesting that in the Central America region, there are, to some extent, country-specific gender differences with

respect to multidimensional poverty. Table 4.5 shows also that the results of Model M2 are similar in all three scenarios, as far as the direction of the gender gap in each of the five countries is concerned. For instance, in the second scenario, adult women living in Honduras and Nicaragua have a lower probability of being multi-dimensionally poor, but the reverse is true for Guatemala and El Salvador. And in Costa Rica multidimensional poverty seems to be gender neutral. For the third scenario, we observe that females are more likely to be poor and that the size of the gender gap observed is smaller in Honduras and Nicaragua than in the other countries, a result that was already stressed in the descriptive analysis.

To shed some light on the determinants of the multidimensional poverty of adults in each country, we also estimate a third logit regression model (Model M3). In M3 we add information on the age of the individuals, their marital status: married, bachelor, divorced, widow(er), the size of the household, the region of residence (urban, rural), and some interaction terms between the sex of the individual and his/her marital status. The results are given, separately for each scenario, in Table 4.6. It appears that model M3 fits generally better the data, so that individual characteristics have also an impact on multidimensional poverty in Central America. For each of the three scenarios the pure gender effect is statistically significant and favors women, but the final impact (size and direction) of the gender on the probability of being multi-dimensionally poor depends, *ceteris paribus*, on the marital status of the individual and the country in which he/she lives.

Table 4.6 also indicates that in Central America, regardless of the scenario considered, there is, ceteris paribus, a U-shaped relationship between the age of the individual and the probability that he/she will be multi-dimensionally poor. The same non-linear relationship is observed for the size of the household. It also appears that, ceteris paribus, adults living in rural areas have a much larger probability of being multi-dimensionally poor, this being true for all scenarios. Such a result was emphasized previously in the literature (see, for instance, Alkire & Santos, 2014; Battiston, Cruces, López-Calva, Lugo, & Santos, 2013; ECLAC, 2013; Espinoza-Delgado & Klasen, 2018; Santos & Villatoro, 2018). In other words, multidimensional poverty in Central America still largely remains a rural phenomenon, an observation that has evidently important policy implications (Espinoza-Delgado & Klasen, 2018). Finally, note that the marital status of an individual and the corresponding interaction terms have a significant impact on the probability of being multi-dimensionally poor.

Table 4.5: Odds ratios of being multi-dimensionally poor by sex and country of residence, considering the three scenarios.

	Scenario 1				Scenario 2				Scenario 3			
Poverty	M1		M2		M1		M2		M1		M2	
Explanatory variables	Odds Ratio	Robust SE	Odds Ratio	Robust SE	Odds Ratio	Robust SE	Odds Ratio	Robust SE	Odds Ratio	Robust SE	Odds Ratio	Robust SE
Sex												
Male (ref.)	1.0000	…	1.0000	…	1.0000	…	1.0000	…	1.0000	…	1.0000	…
Female	0.9443***	0.0203	0.9589	0.0272	1.0675***	0.0234	1.0078	0.0286	1.2713***	0.0282	1.2975***	0.0375
Country												
Costa Rica (ref.)	1.0000	…	1.0000	…	1.0000	…	1.0000	…	1.0000	…	1.0000	…
Guatemala	6.3301***	0.2195	5.9818***	0.2975	6.5274***	0.2320	5.9993***	0.2992	6.4492***	0.2371	6.0236***	0.3016
El Salvador	2.4742***	0.0591	2.4498***	0.0859	2.8826***	0.0717	2.4497***	0.0859	2.5130***	0.0628	2.4358***	0.0855
Honduras	3.7665***	0.0948	4.0635***	0.1528	3.8096***	0.0969	4.1373***	0.1564	3.7178***	0.0977	4.1937***	0.1593
Nicaragua	4.8147***	0.1494	5.2369***	0.2446	4.9053***	0.1548	5.2582***	0.2463	4.7677***	0.1540	5.2461***	0.2461
Interaction												
Female (Guatemala)	…	…	1.1118	0.0771	…	…	1.1791**	0.0839	…	…	1.1594**	0.0858
Female (El Salvador)	…	…	1.0172	0.0487	…	…	1.3697***	0.0682	…	…	1.0639	0.0533
Female (Honduras)	…	…	0.8713***	0.0441	…	…	0.8610***	0.0440	…	…	0.7902***	0.0415
Female (Nicaragua)	…	…	0.8575**	0.0537	…	…	0.8789**	0.0557	…	…	0.8253***	0.0533
Constant	1.3681***	0.0247	1.3572***	0.0278	1.3203***	0.0240	1.3602***	0.0279	1.3821***	0.0253	1.3680***	0.0281
Observations	120756		120756		120756		120756		120756		120756	
Wald chi2	5718.17		5729.86		5871.92		5919.91		5413.38		5455.76	
Degrees of freedom	(5)		(9)		(5)		(9)		(5)		(9)	
Prob. > chi2	0.0000		0.0000		0.0000		0.0000		0.0000		0.0000	
Pseudo R2	0.0675		0.0678		0.0685		0.0696		0.0695		0.0702	

Notes: Survey weights used; outcome (Poverty): dummy equal to 1 if the individual is multi-dimensionally poor, for each of the three scenarios. *Significance levels*: *p < 0.1.; **p < 0.05; ***p < 0.01.

Table 4.6: Odds ratios of being multi-dimensionally poor by sex, age, household size, area and country of residence, and marital status, considering the three scenarios.

	Scenario 1		Scenario 2		Scenario 3	
Poverty	M3		M3		M3	
Explanatory variables	Odds Ratio	Robust SE	Odds Ratio	Robust SE	Odds Ratio	Robust SE
Sex						
Male (ref.)	1.0000	…	1.0000	…	1.0000	…
Female	0.7782***	0.0296	0.7653***	0.0294	0.9152**	0.0355
Age	-0.0039***	0.0006	-0.0042***	0.0005	-0.0049***	0.0005
Age sq.	0.0001***	0.0000	0.0001***	0.0000	0.0001***	0.0000
Household size	-0.0225***	0.0025	-0.0211***	0.0023	-0.0188***	0.0021
Household size sq.	0.0038***	0.0003	0.0036***	0.0002	0.0033***	0.0002
Area of residence						
Urban (ref.)	1.0000	…	1.0000	…	1.0000	…
Rural	5.4221***	0.1124	5.3645***	0.1150	5.4571***	0.1220
Marital status						
Single (ref.)	1.0000	…	1.0000	…	1.0000	…
Married	1.1157***	0.0341	1.1286***	0.0347	1.1400***	0.0352
Unmarried	2.1083***	0.0701	2.1237***	0.0709	2.1377***	0.0717
Divorced	1.4631***	0.0758	1.4804***	0.0768	1.5146***	0.0788
Widow(er)	2.1677***	0.4273	2.1965***	0.4332	2.2030***	0.4350
Country						
Costa Rica (ref.)	1.0000	…	1.0000	…	1.0000	…
Guatemala	4.9466***	0.2034	4.9361***	0.2033	4.9443***	0.2048
El Salvador	2.9120***	0.0880	2.9070***	0.0878	2.8817***	0.0873
Honduras	2.5024***	0.0987	2.5410***	0.1006	2.5645***	0.1024
Nicaragua	3.6196***	0.1428	3.6201***	0.1431	3.6004***	0.1428
Interaction (Sex - Union status)						
Female (Married)	1.3037***	0.0515	1.4877***	0.0602	1.8504***	0.0766
Female (Unmarried)	1.2327***	0.0556	1.4061***	0.0654	1.7658***	0.0851
Female (Divorced)	1.2848***	0.0786	1.3243***	0.0822	1.3685***	0.0853
Female (Widow)	1.1447	0.2407	1.1988	0.2540	1.2932	0.2755
Interaction (Sex - Country)						
Female (Guatemala)	1.1221**	0.0633	1.1996***	0.0690	1.1099*	0.0665
Female (El Salvador)	1.0628	0.0442	1.4498***	0.0619	1.0923**	0.0471
Female (Honduras)	1.0290	0.0552	1.0288	0.0558	0.9509	0.0532
Female (Nicaragua)	0.8656***	0.0461	0.9013*	0.0486	0.8132***	0.0450
Constant	1.5237***	0.1507	1.7072	0.1718	2.0039***	0.2050
Observations	120756		120756		120756	
Wald chi2	16132.39		16264.02		15338.95	
Degrees of freedom	(22)		(22)		(22)	
Prob. > chi2	0.0000		0.0000		0.0000	
Pseudo R2	0.1768		0.1831		0.1821	

Notes: Survey weights used; for age and household size variables, the marginal effects are reported; outcome (Poverty): dummy equal to 1 if individual is multi-dimensionally poor, for each of the three scenarios. *Significance levels*: *p < 0.1.; **p < 0.05; ***p < 0.01.

4.5. Concluding remarks

The AF methodology, as the mainstream approach to the measurement of multidimensional poverty in the developing world, is insensitive to inequality among the multi-dimensionally poor individuals and does not consider simultaneously the concepts of efficiency and distributive justice. Additionally, the vast majority of empirical studies of multidimensional poverty equate the poverty status of the household with that of all individuals in the household, thus disregarding intra-household inequalities, an issue crucial to a better understanding of gender inequalities. In this essay, we proposed individual-based inequality sensitive multidimensional poverty measures that take into account both efficiency and distributive justice. We applied our approach to an analysis of multidimensional poverty among adults (18 to 59 years old) in Guatemala, El Salvador, Honduras, Nicaragua, and Costa Rica, and were thus able to shed some light on gender differences in poverty and inequality in these countries.

It appears that multidimensional poverty among adults is highest in Guatemala and Nicaragua and lowest in Costa Rica. Such findings are quite in tune with the MPI-LA, which shows, for instance, that Guatemala and Nicaragua are the multi-dimensionally poorest countries in Latin America (Santos & Villatoro, 2018, p. 75), and with the recent work of Duryea and Robles (2017), who also suggest that these two countries are the multi-dimensionally poorest ones in Latin America and the Caribbean region (p. 165).

We also decomposed our multidimensional poverty measure into the three I's of poverty and found that Guatemala and Nicaragua have the highest and Costa Rica the lowest incidence and intensity of multidimensional poverty in Central America. El Salvador and Honduras, however, have the greatest levels of inequality.

Our study also indicated that there are statistically significant gender gaps in multidimensional poverty among adults in Guatemala, El Salvador, Honduras, Nicaragua, and Costa Rica. The size and direction of such gaps depend on the deprivation threshold used for employment, that is, on the information incorporated into the analysis. For the incidence of multidimensional poverty, the gender gap is in most cases lower than 5%. In Guatemala, El Salvador and Costa Rica the female poverty incidence rate is higher than that of the males, while no significant gender gap in poverty incidence exists for Honduras and Nicaragua. The female multidimensional poverty intensity seems also to be higher in Guatemala, El Salvador,

and Costa Rica, while the results for Nicaragua and Honduras are ambiguous. Finally, inequality among the multi-dimensionally poor women is clearly higher in Nicaragua (above 8%) and Costa Rica (above 7%), suggesting that in these countries, the multi-dimensionally poor women are living in very intense poverty when compared to the multi-dimensionally poor men. The opposite is true for Guatemala and El Salvador. In Honduras, there does not appear to be gender related differences in inequality among the multi-dimensionally poor adults. In short, in Central America the incidence and intensity of multidimensional poverty are higher among females, while the inequality of poverty is somewhat higher among males.

Finally, the logit regression models corroborate the main findings of our descriptive analysis. *Ceteris paribus*, adults in Guatemala and Nicaragua have the highest and those living in Costa Rica the lowest probability of being multi-dimensionally poor. These regressions also show in Central America, there are country- as well as individual-specific gender differences in multidimensional poverty. It also appears that the total impact of gender is statistically significant, but *ceteris paribus*, it depends also on the marital status of the individuals and the country in which they live.

4.A. Appendix

Table 4.A.1: Percentage of individuals deprived in the domains represented by the different indicators (uncensored headcount ratio); confidence intervals at 95%.
Source: Authors' estimates based on GUA-ENCOVI2014, ELS-EHPM2016, HON-EPHPM2013, NIC-EMNV2014, and CR-ENAHO2016.

		Central America			**Guatemala**			**El Salvador**			**Honduras**			**Nicaragua**			**Costa Rica**		
Dimension	**Indicator**	Lb	**h%**	Ub	Lb	**h%**	Ub	Lb	**h%**	Ub	Lb	**h%**	Ub	Lb	**h%**	Ub	Lb	**h%**	Ub
Education	**Schooling achievement**	56.6	**56.9**	57.3	65.5	**66.2**	66.9	43.0	**43.5**	44.1	58.5	**59.2**	59.9	55.3	**56.2**	57.2	45.3	**45.9**	46.5
Employment	**Employment status (1)**	10.0	**10.2**	10.5	8.0	**8.5**	8.9	8.8	**9.2**	9.6	12.2	**12.7**	13.3	12.7	**13.4**	14.2	8.8	**9.2**	9.5
	Employment status (2)	18.0	**18.3**	18.6	16.0	**16.6**	17.2	28.4	**28.9**	29.4	15.5	**16.1**	16.7	18.8	**19.7**	20.5	10.8	**11.2**	11.6
	Employment status (3)	31.4	**31.7**	32.1	36.4	**37.1**	37.8	28.4	**28.9**	29.4	28.7	**29.4**	30.1	32.2	**33.2**	34.0	21.7	**22.3**	22.8
Water & sanitation	**Improved water source**	19.3	**19.5**	19.8	23.1	**23.6**	24.0	20.5	**20.9**	21.3	11.8	**12.3**	12.8	33.1	**33.8**	34.5	0.6	**0.7**	0.8
	Improved sanitation	38.3	**38.5**	38.8	54.9	**55.4**	56.0	42.2	**42.6**	43.1	22.6	**23.3**	24.0	42.2	**43.1**	43.9	3.8	**4.0**	4.3
Energy & electricity	**Type of cooking fuel**	46.6	**46.8**	47.0	71.8	**72.3**	72.8	9.9	**10.2**	10.5	54.5	**55.1**	55.7	52.2	**52.6**	53.1	3.8	**4.1**	4.3
	Access to electricity	12.8	**13.0**	13.2	17.6	**18.0**	18.5	12.5	**12.8**	13.2	11.6	**12.1**	12.6	12.6	**13.2**	13.9	0.3	**0.4**	0.5
Quality of dwelling	**Housing materials**	23.5	**23.8**	24.1	30.3	**30.9**	31.5	18.1	**18.5**	18.8	17.2	**17.8**	18.3	38.6	**39.4**	40.3	1.5	**1.7**	1.9
	People per bedroom	42.3	**42.7**	43.0	48.9	**49.6**	50.2	44.7	**45.2**	45.8	43.2	**43.9**	44.6	52.7	**53.6**	54.5	6.4	**6.8**	7.1
	Housing tenure	11.2	**11.4**	11.6	9.8	**10.3**	10.7	17.6	**18.1**	18.5	5.2	**5.6**	6.0	15.0	**15.7**	16.5	9.1	**9.5**	9.9
	Assets	25.2	**25.4**	25.7	35.1	**35.7**	36.3	16.4	**16.8**	17.2	22.6	**23.3**	23.9	32.3	**33.2**	34.1	2.3	**2.4**	2.6

Notes: Survey weights used; Lb: Lower bound; h: Uncensored headcount ratio; Ub: Upper bound. The confidence intervals at 95% were computed using the bootstrap percentile method with 1,000 stratified bootstrap replications (Efron, 1981, p. 145).

Table 4.A.2: Multidimensional poverty in Guatemala, El Salvador, Honduras, Nicaragua, and Costa Rica, as well as in Central America as a whole, assuming several degrees of inequality aversion; confidence intervals at 95%.
Source: Authors' estimates based on GUA-ENCOVI2014, ELS-EHPM2016, HON-EPHPM2013, NIC-EMNV2014, and CR-ENAHO2016.

Panel I: Scenario 1

	Central America			**Guatemala**			**El Salvador**			**Honduras**			**Nicaragua**			**Costa Rica**		
Gamma	Lb	**MPI**	Ub	Lb	**MPI**	Ub	Lb	**MPI**	Ub	Lb	**MPI**	Ub	Lb	**MPI**	Ub	Lb	**MPI**	Ub
0.00	0.2750	**0.2762**	0.2774	0.3370	**0.3394**	0.3418	0.2291	**0.2311**	0.2331	0.2579	**0.2607**	0.2639	0.3207	**0.3238**	0.3270	0.1261	**0.1278**	0.1294
0.25	0.2209	**0.2220**	0.2232	0.2761	**0.2784**	0.2807	0.1793	**0.1812**	0.1831	0.2030	**0.2058**	0.2085	0.2638	**0.2670**	0.2701	0.0889	**0.0902**	0.0914
0.50	0.1800	**0.1810**	0.1821	0.2288	**0.2310**	0.2331	0.1426	**0.1444**	0.1460	0.1627	**0.1651**	0.1675	0.2205	**0.2235**	0.2267	0.0633	**0.0642**	0.0652
0.75	0.1486	**0.1496**	0.1505	0.1919	**0.1938**	0.1958	0.1154	**0.1167**	0.1181	0.1320	**0.1342**	0.1364	0.1863	**0.1891**	0.1923	0.0454	**0.0462**	0.0470
1.00	0.1241	**0.1250**	0.1259	0.1621	**0.1640**	0.1659	0.0941	**0.0955**	0.0968	0.1084	**0.1104**	0.1126	0.1589	**0.1618**	0.1647	0.0328	**0.0335**	0.0341
1.25	0.1047	**0.1056**	0.1064	0.1383	**0.1402**	0.1419	0.0778	**0.0790**	0.0801	0.0900	**0.0920**	0.0940	0.1369	**0.1397**	0.1425	0.0240	**0.0245**	0.0250
1.50	0.0891	**0.0900**	0.0908	0.1189	**0.1206**	0.1224	0.0649	**0.0661**	0.0672	0.0756	**0.0774**	0.0791	0.1189	**0.1215**	0.1240	0.0177	**0.0181**	0.0185
1.75	0.0766	**0.0774**	0.0782	0.1030	**0.1046**	0.1061	0.0548	**0.0558**	0.0568	0.0640	**0.0657**	0.0675	0.1038	**0.1064**	0.1090	0.0132	**0.0135**	0.0139
2.00	0.0664	**0.0671**	0.0678	0.0897	**0.0913**	0.0928	0.0465	**0.0475**	0.0485	0.0549	**0.0563**	0.0579	0.0913	**0.0939**	0.0962	0.0099	**0.0102**	0.0105

Panel II: Scenario 2

	Central America			**Guatemala**			**El Salvador**			**Honduras**			**Nicaragua**			**Costa Rica**		
Gamma	Lb	**MPI**	Ub	Lb	**MPI**	Ub	Lb	**MPI**	Ub	Lb	**MPI**	Ub	Lb	**MPI**	Ub	Lb	**MPI**	Ub
0.00	0.2912	**0.2924**	0.2937	0.3533	**0.3559**	0.3586	0.2684	**0.2705**	0.2726	0.2645	**0.2673**	0.2702	0.3330	**0.3362**	0.3395	0.1302	**0.1318**	0.1336
0.25	0.2362	**0.2373**	0.2386	0.2920	**0.2944**	0.2968	0.2161	**0.2181**	0.2202	0.2093	**0.2119**	0.2145	0.2760	**0.2794**	0.2827	0.0922	**0.0936**	0.0948
0.50	0.1943	**0.1955**	0.1966	0.2443	**0.2465**	0.2487	0.1768	**0.1786**	0.1806	0.1680	**0.1705**	0.1729	0.2321	**0.2354**	0.2387	0.0660	**0.0671**	0.0681
0.75	0.1620	**0.1631**	0.1641	0.2065	**0.2087**	0.2109	0.1467	**0.1483**	0.1501	0.1369	**0.1391**	0.1416	0.1974	**0.2005**	0.2038	0.0477	**0.0485**	0.0493
1.00	0.1367	**0.1377**	0.1387	0.1763	**0.1783**	0.1803	0.1232	**0.1247**	0.1262	0.1128	**0.1149**	0.1172	0.1699	**0.1727**	0.1758	0.0348	**0.0354**	0.0361
1.25	0.1165	**0.1174**	0.1184	0.1515	**0.1535**	0.1554	0.1045	**0.1060**	0.1074	0.0941	**0.0960**	0.0981	0.1471	**0.1501**	0.1532	0.0256	**0.0261**	0.0267
1.50	0.1002	**0.1011**	0.1021	0.1316	**0.1333**	0.1351	0.0897	**0.0911**	0.0925	0.0792	**0.0810**	0.0828	0.1286	**0.1316**	0.1346	0.0190	**0.0195**	0.0199
1.75	0.0869	**0.0878**	0.0887	0.1148	**0.1166**	0.1184	0.0776	**0.0789**	0.0803	0.0674	**0.0691**	0.0709	0.1131	**0.1160**	0.1189	0.0142	**0.0146**	0.0150
2.00	0.0760	**0.0768**	0.0777	0.1010	**0.1026**	0.1043	0.0676	**0.0689**	0.0703	0.0577	**0.0594**	0.0611	0.1001	**0.1031**	0.1060	0.0108	**0.0111**	0.0115

Notes: Survey weights used; Lb: Lower bound; Ub: Upper bound. The confidence intervals at 95% were computed using the bootstrap percentile method with 1,000 stratified bootstrap replications (Efron, 1981, p. 145).

Table 4.A.2-(*continued*)

Panel III: Scenario 3

	Central America			**Guatemala**			**El Salvador**			**Honduras**			**Nicaragua**			**Costa Rica**		
Gamma	Lb	**MPI**	Ub	Lb	**MPI**	Ub	Lb	**MPI**	Ub	Lb	**MPI**	Ub	Lb	**MPI**	Ub	Lb	**MPI**	Ub
0.00	0.3180	**0.3192**	0.3206	0.3939	**0.3967**	0.3994	0.2684	**0.2705**	0.2726	0.2909	**0.2940**	0.2970	0.3602	**0.3633**	0.3666	0.1520	**0.1539**	0.1557
0.25	0.2627	**0.2640**	0.2652	0.3339	**0.3364**	0.3389	0.2161	**0.2181**	0.2202	0.2345	**0.2374**	0.2401	0.3030	**0.3065**	0.3099	0.1111	**0.1124**	0.1138
0.50	0.2203	**0.2215**	0.2227	0.2862	**0.2887**	0.2911	0.1768	**0.1786**	0.1806	0.1915	**0.1946**	0.1975	0.2588	**0.2624**	0.2661	0.0818	**0.0830**	0.0842
0.75	0.1871	**0.1883**	0.1895	0.2479	**0.2502**	0.2527	0.1467	**0.1483**	0.1501	0.1592	**0.1617**	0.1644	0.2240	**0.2273**	0.2305	0.0609	**0.0619**	0.0630
1.00	0.1607	**0.1619**	0.1630	0.2167	**0.2191**	0.2216	0.1232	**0.1247**	0.1262	0.1336	**0.1360**	0.1385	0.1957	**0.1990**	0.2022	0.0458	**0.0466**	0.0474
1.25	0.1396	**0.1406**	0.1417	0.1909	**0.1933**	0.1955	0.1045	**0.1060**	0.1074	0.1132	**0.1156**	0.1180	0.1725	**0.1759**	0.1793	0.0348	**0.0355**	0.0362
1.50	0.1222	**0.1233**	0.1244	0.1694	**0.1717**	0.1739	0.0897	**0.0911**	0.0925	0.0971	**0.0994**	0.1016	0.1531	**0.1566**	0.1603	0.0267	**0.0272**	0.0278
1.75	0.1080	**0.1091**	0.1102	0.1514	**0.1536**	0.1558	0.0776	**0.0789**	0.0803	0.0841	**0.0862**	0.0883	0.1372	**0.1407**	0.1440	0.0206	**0.0211**	0.0216
2.00	0.0961	**0.0971**	0.0981	0.1362	**0.1382**	0.1404	0.0676	**0.0689**	0.0703	0.0733	**0.0754**	0.0774	0.1238	**0.1271**	0.1302	0.0161	**0.0165**	0.0169

Notes: Survey weights used; Lb: Lower bound; Ub: Upper bound. The confidence intervals at 95% were computed using the bootstrap percentile method with 1,000 stratified bootstrap replications (Efron, 1981, p. 145).

Table 4.A.3: The incidence (H) and intensity (A) of multidimensional poverty in Guatemala (GUA), El Salvador (ELS), Honduras (HON), Nicaragua (NIC), and Costa Rica (CR), as well as in Central America (CA) as a whole; confidence intervals at 95%.
Source: Authors' estimates based on GUA-ENCOVI2014, ELS-EHPM2016, HON-EPHPM2013, NIC-EMNV2014, and CR-ENAHO2016.

Panel I: The incidence of multidimensional poverty (H%): The multidimensional headcount ratio

	Scenario 1 (S1)			**Scenario 2 (S2)**			**Scenario 3 (S3)**			**Dif.: S2-S1**		**Dif.: S3-S2**		**Dif.: S3-S1**	
Country	Lb	**H (%)**	Ub	Lb	**H (%)**	Ub	Lb	**H (%)**	Ub	Abs.	Rel.	Abs.	Rel.	Abs.	Rel.
GUA	88.9	**89.4**	89.8	89.5	**89.9**	90.4	90.5	**91.0**	91.4	0.55***	1.01	1.06***	1.01	1.62***	1.02
ELS	76.1	**76.6**	77.2	79.2	**79.8**	80.3	79.2	**79.8**	80.3	3.12***	1.04	0.00	1.00	3.12***	1.04
HON	82.8	**83.3**	83.8	83.4	**83.9**	84.5	84.9	**85.3**	85.8	0.57***	1.01	1.43***	1.02	2.00***	1.02
NIC	86.0	**86.5**	86.9	86.6	**87.0**	87.5	87.7	**88.2**	88.6	0.55***	1.01	1.14***	1.01	1.69***	1.02
CR	56.4	**57.0**	57.7	57.1	**57.7**	58.4	60.4	**61.0**	61.6	0.70***	1.01	3.24***	1.06	3.94***	1.07
CA	81.2	**81.4**	81.6	82.1	**82.4**	82.6	83.4	**83.6**	83.9	1.00***	1.01	1.26***	1.02	2.25***	1.03

Panel II: The intensity of multidimensional poverty (A): The average deprivation share

	Scenario 1 (S1)			**Scenario 2 (S2)**			**Scenario 3 (S3)**			**Dif.: S2-S1**		**Dif.: S3-S2**		**Dif.: S3-S1**	
Country	Lb	**A (%)**	Ub	Lb	**A (%)**	Ub	Lb	**A (%)**	Ub	Abs.	Rel.	Abs.	Rel.	Abs.	Rel.
GUA	37.8	**38.0**	38.2	39.3	**39.6**	39.8	43.4	**43.6**	43.9	1.58***	1.04	4.05***	1.10	5.62***	1.15
ELS	30.0	**30.2**	30.4	33.7	**33.9**	34.1	33.7	**33.9**	34.1	3.75***	1.12	0.00***	1.00	3.75***	1.12
HON	31.0	**31.3**	31.6	31.6	**31.9**	32.2	34.2	**34.5**	34.8	0.59***	1.02	2.59***	1.08	3.18***	1.10
NIC	37.1	**37.5**	37.8	38.3	**38.6**	39.0	40.8	**41.2**	41.6	1.19***	1.03	2.57***	1.07	3.76***	1.10
CR	22.2	**22.4**	22.6	22.7	**22.8**	23.0	25.1	**25.2**	25.4	0.45***	1.02	2.40***	1.10	2.84***	1.13
CA	33.8	**33.9**	34.1	35.4	**35.5**	35.6	38.0	**38.2**	38.3	1.55***	1.05	2.68***	1.08	4.23***	1.12

Notes: Survey weights used; Lb: Lower bound; H: The multidimensional headcount ratio; A: The average deprivation share among the multi-dimensionally poor individuals; Ub: Upper bound; the confidence intervals at 95% were computed using the bootstrap percentile method with 1,000 stratified bootstrap replications (Efron, 1981, p. 145). *Significance levels:* *p < 0.1; **p < 0.05; ***p < 0.01.

Table 4.A.4: Inequality among the multi-dimensionally poor individuals in Guatemala (GUA), EL Salvador (ELS), Honduras (HON), Nicaragua (NIC), and Costa Rica (CR), as well as in Central America as a whole; confidence intervals at 95 percent.
Source: Authors' estimates based on GUA-ENCOVI2014, ELS-EHPM2016, HON-EPHPM2013, NIC-EMNV2014, and CR-ENAHO2016.

Panel I: Scenario 1

	γ = 0.25			γ = 0.50			γ = 0.75			γ = 1.00		
Country	Lb	**GE (1 +γ)**	Ub	Lb	**GE (1 +γ)**	Ub	Lb	**GE (1 +γ)**	Ub	Lb	**GE (1 +γ)**	Ub
GUA	0.1392	**0.1421**	0.1451	0.1358	**0.1388**	0.1419	0.1343	**0.1371**	0.1401	0.1335	**0.1362**	0.1391
ELS	0.1819	**0.1851**	0.1884	0.1797	**0.1830**	0.1863	0.1796	**0.1828**	0.1858	0.1812	**0.1847**	0.1878
HON	0.1749	**0.1789**	0.1827	0.1726	**0.1764**	0.1804	0.1718	**0.1757**	0.1797	0.1734	**0.1774**	0.1813
NIC	0.1703	**0.1742**	0.1784	0.1658	**0.1699**	0.1738	0.1640	**0.1678**	0.1719	0.1630	**0.1670**	0.1710
CR	0.0799	**0.0828**	0.0856	0.0801	**0.0829**	0.0856	0.0806	**0.0834**	0.0862	0.0818	**0.0850**	0.0882
CA	0.1667	**0.1685**	0.1702	0.1644	**0.1661**	0.1677	0.1638	**0.1655**	0.1672	0.1646	**0.1665**	0.1684
	γ = 1.25			γ = 1.50			γ = 1.75			γ = 2.00		
Country	Lb	**GE (1 +γ)**	Ub	Lb	**GE (1 +γ)**	Ub	Lb	**GE (1 +γ)**	Ub	Lb	**GE (1 +γ)**	Ub
GUA	0.1337	**0.1367**	0.1401	0.1348	**0.1381**	0.1414	0.1372	**0.1405**	0.1439	0.1403	**0.1437**	0.1472
ELS	0.1849	**0.1883**	0.1918	0.1899	**0.1936**	0.1975	0.1968	**0.2007**	0.2047	0.2054	**0.2098**	0.2142
HON	0.1762	**0.1806**	0.1850	0.1811	**0.1857**	0.1901	0.1877	**0.1927**	0.1977	0.1957	**0.2014**	0.2068
NIC	0.1636	**0.1678**	0.1723	0.1654	**0.1699**	0.1745	0.1684	**0.1732**	0.1776	0.1730	**0.1777**	0.1828
CR	0.0837	**0.0872**	0.0907	0.0867	**0.0902**	0.0936	0.0900	**0.0939**	0.0978	0.0944	**0.0988**	0.1029
CA	0.1670	**0.1689**	0.1707	0.1706	**0.1727**	0.1747	0.1759	**0.1779**	0.1801	0.1824	**0.1847**	0.1871

Panel II: Scenario 2

	γ = 0.25			γ = 0.50			γ = 0.75			γ = 1.00		
Country	Lb	**GE (1 +γ)**	Ub	Lb	**GE (1 +γ)**	Ub	Lb	**GE (1 +γ)**	Ub	Lb	**GE (1 +γ)**	Ub
GUA	0.1357	**0.1385**	0.1413	0.1323	**0.1354**	0.1385	0.1309	**0.1338**	0.1368	0.1300	**0.1331**	0.1360
ELS	0.1772	**0.1801**	0.1832	0.1752	**0.1781**	0.1810	0.1747	**0.1778**	0.1806	0.1763	**0.1795**	0.1827
HON	0.1714	**0.1753**	0.1793	0.1689	**0.1729**	0.1770	0.1687	**0.1726**	0.1767	0.1699	**0.1741**	0.1779
NIC	0.1672	**0.1711**	0.1753	0.1632	**0.1671**	0.1709	0.1610	**0.1650**	0.1691	0.1603	**0.1643**	0.1683
CR	0.0832	**0.0859**	0.0887	0.0834	**0.0860**	0.0887	0.0843	**0.0869**	0.0897	0.0856	**0.0885**	0.0914
CA	0.1636	**0.1653**	0.1669	0.1614	**0.1631**	0.1649	0.1609	**0.1625**	0.1643	0.1617	**0.1635**	0.1652
	γ = 1.25			γ = 1.50			γ = 1.75			γ = 2.00		
Country	Lb	**GE (1 +γ)**	Ub	Lb	**GE (1 +γ)**	Ub	Lb	**GE (1 +γ)**	Ub	Lb	**GE (1 +γ)**	Ub
GUA	0.1307	**0.1335**	0.1363	0.1320	**0.1350**	0.1380	0.1343	**0.1373**	0.1404	0.1371	**0.1405**	0.1439
ELS	0.1793	**0.1828**	0.1863	0.1843	**0.1876**	0.1911	0.1904	**0.1942**	0.1980	0.1986	**0.2026**	0.2068
HON	0.1731	**0.1773**	0.1813	0.1776	**0.1825**	0.1873	0.1842	**0.1890**	0.1940	0.1921	**0.1976**	0.2029
NIC	0.1610	**0.1652**	0.1695	0.1627	**0.1672**	0.1718	0.1662	**0.1707**	0.1752	0.1702	**0.1754**	0.1805
CR	0.0878	**0.0910**	0.0941	0.0910	**0.0941**	0.0972	0.0945	**0.0981**	0.1017	0.0988	**0.1030**	0.1073
CA	0.1640	**0.1659**	0.1678	0.1676	**0.1696**	0.1717	0.1727	**0.1747**	0.1769	0.1789	**0.1812**	0.1835

Notes: Survey weights used; Lb: Lower bound; GE: The generalized entropy inequality index; Ub: Upper bound; the confidence intervals at 95% were computed using the bootstrap percentile method with 1,000 stratified bootstrap replications (Efron, 1981, p. 145).

Table 4.A.4-(*continued*).

Panel III: Scenario 3

	γ = 0.25			γ = 0.50			γ = 0.75			γ = 1.00		
Country	Lb	**GE (1 +γ)**	Ub	Lb	**GE (1 +γ)**	Ub	Lb	**GE (1 +γ)**	Ub	Lb	**GE (1 +γ)**	Ub
GUA	0.1360	**0.1388**	0.1418	0.1326	**0.1356**	0.1384	0.1307	**0.1336**	0.1365	0.1298	**0.1328**	0.1355
ELS	0.1772	**0.1801**	0.1832	0.1752	**0.1781**	0.1810	0.1747	**0.1778**	0.1806	0.1763	**0.1795**	0.1827
HON	0.1682	**0.1723**	0.1762	0.1661	**0.1699**	0.1737	0.1660	**0.1696**	0.1733	0.1672	**0.1711**	0.1750
NIC	0.1672	**0.1708**	0.1747	0.1634	**0.1672**	0.1709	0.1616	**0.1652**	0.1690	0.1612	**0.1649**	0.1687
CR	0.0950	**0.0975**	0.1001	0.0952	**0.0976**	0.1000	0.0961	**0.0985**	0.1009	0.0975	**0.1000**	0.1027
CA	0.1647	**0.1662**	0.1679	0.1624	**0.1640**	0.1656	0.1618	**0.1634**	0.1650	0.1626	**0.1643**	0.1661
	γ = 1.25			γ = 1.50			γ = 1.75			γ = 2.00		
Country	Lb	**GE (1 +γ)**	Ub	Lb	**GE (1 +γ)**	Ub	Lb	**GE (1 +γ)**	Ub	Lb	**GE (1 +γ)**	Ub
GUA	0.1302	**0.1329**	0.1359	0.1312	**0.1340**	0.1371	0.1330	**0.1359**	0.1388	0.1357	**0.1387**	0.1418
ELS	0.1793	**0.1828**	0.1863	0.1843	**0.1876**	0.1911	0.1904	**0.1942**	0.1980	0.1986	**0.2026**	0.2068
HON	0.1702	**0.1742**	0.1781	0.1747	**0.1788**	0.1834	0.1806	**0.1852**	0.1898	0.1881	**0.1930**	0.1982
NIC	0.1621	**0.1659**	0.1701	0.1644	**0.1683**	0.1726	0.1673	**0.1718**	0.1760	0.1723	**0.1770**	0.1817
CR	0.0995	**0.1023**	0.1050	0.1026	**0.1053**	0.1081	0.1059	**0.1090**	0.1123	0.1104	**0.1136**	0.1172
CA	0.1647	**0.1666**	0.1683	0.1681	**0.1702**	0.1721	0.1732	**0.1751**	0.1772	0.1793	**0.1814**	0.1835

Notes: Survey weights used; Lb: Lower bound; GE: The generalized entropy inequality index; Ub: Upper bound; the confidence intervals at 95% were computed using the bootstrap percentile method with 1,000 stratified bootstrap replications (Efron, 1981, p. 145).

Table 4.A.5: Multidimensional poverty by gender in Guatemala (GUA), EL Salvador (ELS), Honduras (HON), Nicaragua (NIC), and Costa Rica (CR), for scenario 1 and with various degrees of inequality aversion.
Source: Authors' estimates based on GUA-ENCOVI2014, ELS-EHPM2016, HON-EPHPM2013, NIC-EMNV2014, and CR-ENAHO2016.

Country	Gender/Gender gap	Value of γ								
		0.00	**0.25**	**0.50**	**0.75**	**1.00**	**1.25**	**1.50**	**1.75**	**2.00**
GUA	Male	0.3438	0.2836	0.2369	0.2000	0.1705	0.1469	0.1273	0.1111	0.0976
		(0.0018)	(0.0017)	(0.0016)	(0.0016)	(0.0015)	(0.0015)	(0.0014)	(0.0013)	(0.0013)
	Female	0.3358	0.2738	0.2259	0.1883	0.1584	0.1344	0.1149	0.0988	0.0856
		(0.0017)	(0.0015)	(0.0014)	(0.0013)	(0.0012)	(0.0012)	(0.0011)	(0.0010)	(0.0010)
	Absolute gap	*-0.0080****	*-0.0098****	*-0.0110****	*-0.0118****	*-0.0121****	*-0.0125****	*-0.0124****	*-0.0123****	*-0.0120****
	Relative gap	*0.98*	*0.97*	*0.95*	*0.94*	*0.93*	*0.91*	*0.90*	*0.89*	*0.88*
ELS	Male	0.2357	0.1859	0.1491	0.1213	0.1000	0.0833	0.0701	0.0597	0.0511
		(0.0015)	(0.0014)	(0.0012)	(0.0011)	(0.0010)	(0.0010)	(0.0009)	(0.0008)	(0.0008)
	Female	0.2274	0.1773	0.1405	0.1128	0.0917	0.0755	0.0626	0.0526	0.0445
		(0.0014)	(0.0012)	(0.0011)	(0.0010)	(0.0009)	(0.0008)	(0.0007)	(0.0007)	(0.0006)
	Absolute gap	*-0.0082****	*-0.0085****	*-0.0086****	*-0.0085****	*-0.0083****	*-0.0079****	*-0.0075****	*-0.0071****	*-0.0067****
	Relative gap	*0.97*	*0.95*	*0.94*	*0.93*	*0.92*	*0.91*	*0.89*	*0.88*	*0.87*
HON	Male	0.2807	0.2249	0.1827	0.1506	0.1255	0.1059	0.0901	0.0774	0.0672
		(0.0022)	(0.0021)	(0.0019)	(0.0018)	(0.0017)	(0.0016)	(0.0015)	(0.0015)	(0.0014)
	Female	0.2432	0.1894	0.1498	0.1200	0.0974	0.0799	0.0663	0.0555	0.0469
		(0.0019)	(0.0017)	(0.0015)	(0.0014)	(0.0013)	(0.0012)	(0.0011)	(0.0010)	(0.0010)
	Absolute gap	*-0.0375****	*-0.0355****	*-0.0329****	*-0.0306****	*-0.0281****	*-0.0260****	*-0.0239****	*-0.0219****	*-0.0203****
	Relative gap	*0.87*	*0.84*	*0.82*	*0.80*	*0.78*	*0.75*	*0.74*	*0.72*	*0.70*
NIC	Male	0.3411	0.2830	0.2381	0.2026	0.1739	0.1506	0.1313	0.1153	0.1020
		(0.0023)	(0.0023)	(0.0023)	(0.0022)	(0.0022)	(0.0022)	(0.0021)	(0.0020)	(0.0019)
	Female	0.3083	0.2529	0.2104	0.1772	0.1510	0.1298	0.1125	0.0984	0.0864
		(0.0023)	(0.0022)	(0.0022)	(0.0021)	(0.0020)	(0.0019)	(0.0019)	(0.0018)	(0.0017)
	Absolute gap	*-0.0328****	*-0.0301****	*-0.0277****	*-0.0254****	*-0.0229****	*-0.0208****	*0.0188****	*0.0170****	*0.0156****
	Relative gap	*0.90*	*0.89*	*0.88*	*0.87*	*0.87*	*0.86*	*0.86*	*0.85*	*0.85*
CR	Male	0.1288	0.0908	0.0645	0.0463	0.0335	0.0245	0.0181	0.0135	0.0101
		(0.0012)	(0.0009)	(0.0007)	(0.0006)	(0.0004)	(0.0004)	(0.0003)	(0.0003)	(0.0002)
	Female	0.1267	0.0896	0.0639	0.0460	0.0334	0.0245	0.0182	0.0136	0.0103
		(0.0012)	(0.0009)	(0.0007)	(0.0005)	(0.0004)	(0.0004)	(0.0003)	(0.0003)	(0.0002)
	Absolute gap	*-0.0021****	*-0.0012****	*-0.0006****	*-0.0003****	*0.0000***	*0.0001****	*0.0001****	*0.0001****	*0.0001****
	Relative gap	*0.98*	*0.99*	*0.99*	*0.99*	*1.00*	*1.00*	*1.01*	*1.01*	*1.01*

Notes: Survey weights used; standard errors (in parentheses) were estimated following the bootstrap estimate of the standard error proposed by Bradley Efron with 1000 stratified bootstrap replications (Efron, 1981, p. 139-143). *Significance levels:* *p < 0.1; **p < 0.05; ***p < 0.01.

Table 4.A.6: Multidimensional poverty by gender in Guatemala (GUA), EL Salvador (ELS), Honduras (HON), Nicaragua (NIC), and Costa Rica (CR), for scenario 2, with various degrees of inequality aversion.
Source: Authors' estimates based on GUA-ENCOVI2014, ELS-EHPM2016, HON-EPHPM2013, NIC-EMNV2014, and CR-ENAHO2016.

Country	Gender/Gender gap	Value of γ								
		0.00	**0.25**	**0.50**	**0.75**	**1.00**	**1.25**	**1.50**	**1.75**	**2.00**
GUA	Male	0.3451	0.2848	0.2380	0.2011	0.1715	0.1475	0.1280	0.1118	0.0984
		(0.0018)	(0.0017)	(0.0017)	(0.0016)	(0.0015)	(0.0014)	(0.0014)	(0.0013)	(0.0013)
	Female	0.3652	0.3028	0.2540	0.2152	0.1840	0.1588	0.1380	0.1208	0.1064
		(0.0018)	(0.0017)	(0.0016)	(0.0016)	(0.0014)	(0.0014)	(0.0013)	(0.0013)	(0.0012)
	Absolute gap	*0.0202****	*0.0180****	*0.0161****	*0.0142****	*0.0125****	*0.0113****	*0.0101****	*0.0090****	*0.0080****
	Relative gap	*1.06*	*1.06*	*1.07*	*1.07*	*1.07*	*1.08*	*1.08*	*1.08*	*1.08*
ELS	Male	0.2361	0.1863	0.1494	0.1215	0.1003	0.0835	0.0703	0.0598	0.0513
		(0.0016)	(0.0014)	(0.0012)	(0.0011)	(0.0011)	(0.0009)	(0.0009)	(0.0008)	(0.0007)
	Female	0.2993	0.2446	0.2029	0.1706	0.1451	0.1247	0.1082	0.0948	0.0836
		(0.0016)	(0.0014)	(0.0013)	(0.0013)	(0.0012)	(0.0012)	(0.0011)	(0.0011)	(0.0010)
	Absolute gap	*0.0632****	*0.0583****	*0.0535****	*0.0490****	*0.0448****	*0.0412****	*0.0379****	*0.0350****	*0.0322****
	Relative gap	*1.27*	*1.31*	*1.36*	*1.40*	*1.45*	*1.49*	*1.54*	*1.59*	*1.63*
HON	Male	0.2823	0.2262	0.1839	0.1515	0.1264	0.1065	0.0907	0.0780	0.0676
		(0.0022)	(0.0021)	(0.0020)	(0.0018)	(0.0017)	(0.0016)	(0.0016)	(0.0015)	(0.0014)
	Female	0.2543	0.1996	0.1589	0.1285	0.1050	0.0869	0.0726	0.0613	0.0523
		(0.0019)	(0.0017)	(0.0016)	(0.0015)	(0.0014)	(0.0013)	(0.0012)	(0.0012)	(0.0011)
	Absolute gap	*-0.0280****	*-0.0266****	*-0.0250****	*-0.0231****	*-0.0214****	*-0.0197****	*-0.0181****	*-0.0167****	*-0.0152****
	Relative gap	*0.90*	*0.88*	*0.86*	*0.85*	*0.83*	*0.82*	*0.80*	*0.79*	*0.77*
NIC	Male	0.3416	0.2837	0.2384	0.2029	0.1742	0.1508	0.1315	0.1157	0.1022
		(0.0024)	(0.0024)	(0.0023)	(0.0023)	(0.0022)	(0.0021)	(0.0022)	(0.0020)	(0.0019)
	Female	0.3315	0.2756	0.2324	0.1985	0.1714	0.1494	0.1314	0.1164	0.1038
		(0.0025)	(0.0025)	(0.0025)	(0.0024)	(0.0024)	(0.0023)	(0.0023)	(0.0022)	(0.0022)
	Absolute gap	*-0.0101****	*-0.0081****	*-0.0060****	*-0.0044****	*-0.0028****	*-0.0014****	*-0.0002**	*0.0007****	*0.0016****
	Relative gap	*0.97*	*0.97*	*0.97*	*0.98*	*0.98*	*0.99*	*1.00*	*1.01*	*1.02*
CR	Male	0.1292	0.0911	0.0648	0.0465	0.0337	0.0246	0.0182	0.0135	0.0102
		(0.0012)	(0.0009)	(0.0007)	(0.0006)	(0.0005)	(0.0004)	(0.0003)	(0.0003)	(0.0002)
	Female	0.1343	0.0959	0.0691	0.0504	0.0371	0.0275	0.0207	0.0156	0.0120
		(0.0013)	(0.0010)	(0.0007)	(0.0006)	(0.0005)	(0.0004)	(0.0003)	(0.0003)	(0.0002)
	Absolute gap	*0.0051****	*0.0049****	*0.0043****	*0.0038****	*0.0034****	*0.0030****	*0.0025****	*0.0021****	*0.0017****
	Relative gap	*1.04*	*1.05*	*1.07*	*1.08*	*1.10*	*1.12*	*1.14*	*1.15*	*1.17*

Notes: Survey weights used; standard errors (in parentheses) were estimated following the bootstrap estimate of the standard error proposed by Bradley Efron with 1000 stratified bootstrap replications (Efron, 1981, p. 139-143). *Significance levels:* *p < 0.1; **p < 0.05; ***p < 0.01.

Table 4.A.7: Multidimensional poverty by gender in Guatemala (GUA), EL Salvador (ELS), Honduras (HON), Nicaragua (NIC), and Costa Rica (CR), for scenario 3, with various degrees of inequality aversion.
Source: Authors' estimates based on GUA-ENCOVI2014, ELS-EHPM2016, HON-EPHPM2013, NIC-EMNV2014, and CR-ENAHO2016.

Country	Gender/Gender gap	Value of γ								
		0.00	**0.25**	**0.50**	**0.75**	**1.00**	**1.25**	**1.50**	**1.75**	**2.00**
GUA	Male	0.3465	0.2862	0.2393	0.2022	0.1726	0.1486	0.1290	0.1127	0.0991
		(0.0019)	(0.0018)	(0.0017)	(0.0016)	(0.0015)	(0.0015)	(0.0014)	(0.0013)	(0.0013)
	Female	0.4407	0.3803	0.3319	0.2924	0.2596	0.2322	0.2091	0.1894	0.1725
		(0.0021)	(0.0020)	(0.0020)	(0.0019)	(0.0019)	(0.0019)	(0.0018)	(0.0017)	(0.0016)
	Absolute gap	*0.0942****	*0.0941****	*0.0926****	*0.0901****	*0.0870****	*0.0836****	*0.0801****	*0.0767****	*0.0734****
	Relative gap	*1.27*	*1.33*	*1.39*	*1.45*	*1.50*	*1.56*	*1.62*	*1.68*	*1.74*
ELS	Male	0.2361	0.1863	0.1494	0.1215	0.1003	0.0835	0.0703	0.0598	0.0513
		(0.0016)	(0.0014)	(0.0012)	(0.0011)	(0.0011)	(0.0009)	(0.0009)	(0.0008)	(0.0007)
	Female	0.2993	0.2446	0.2029	0.1706	0.1451	0.1247	0.1082	0.0948	0.0836
		(0.0016)	(0.0014)	(0.0013)	(0.0013)	(0.0012)	(0.0012)	(0.0011)	(0.0011)	(0.0010)
	Absolute gap	*0.0632****	*0.0583****	*0.0535****	*0.0490****	*0.0448****	*0.0412****	*0.0379****	*0.0350****	*0.0322****
	Relative gap	*1.27*	*1.31*	*1.36*	*1.40*	*1.45*	*1.49*	*1.54*	*1.59*	*1.63*
HON	Male	0.2835	0.2271	0.1846	0.1520	0.1268	0.1069	0.0911	0.0783	0.0679
		(0.0022)	(0.0020)	(0.0019)	(0.0018)	(0.0017)	(0.0016)	(0.0015)	(0.0014)	(0.0014)
	Female	0.3030	0.2464	0.2032	0.1700	0.1439	0.1232	0.1065	0.0930	0.0818
		(0.0022)	(0.0022)	(0.0020)	(0.0019)	(0.0018)	(0.0017)	(0.0017)	(0.0016)	(0.0016)
	Absolute gap	*0.0195****	*0.0192****	*0.0186****	*0.0180****	*0.0171****	*0.0163****	*0.0155****	*0.0147****	*0.0140****
	Relative gap	*1.07*	*1.08*	*1.10*	*1.12*	*1.13*	*1.15*	*1.17*	*1.19*	*1.21*
NIC	Male	0.3423	0.2841	0.2390	0.2033	0.1746	0.1512	0.1319	0.1159	0.1024
		(0.0024)	(0.0024)	(0.0023)	(0.0023)	(0.0022)	(0.0022)	(0.0022)	(0.0019)	(0.0019)
	Female	0.3822	0.3268	0.2835	0.2489	0.2211	0.1980	0.1790	0.1630	0.1494
		(0.0026)	(0.0027)	(0.0026)	(0.0027)	(0.0026)	(0.0027)	(0.0026)	(0.0026)	(0.0027)
	Absolute gap	*0.0399****	*0.0427****	*0.0445****	*0.0457****	*0.0466****	*0.0468****	*0.0472****	*0.0471****	*0.0470****
	Relative gap	*1.12*	*1.15*	*1.19*	*1.22*	*1.27*	*1.31*	*1.36*	*1.41*	*1.46*
CR	Male	0.1298	0.0916	0.0652	0.0468	0.0339	0.0248	0.0184	0.0137	0.0103
		(0.0012)	(0.0009)	(0.0007)	(0.0006)	(0.0005)	(0.0004)	(0.0003)	(0.0003)	(0.0002)
	Female	0.1763	0.1317	0.0995	0.0759	0.0584	0.0453	0.0355	0.0280	0.0222
		(0.0015)	(0.0012)	(0.0010)	(0.0008)	(0.0007)	(0.0006)	(0.0005)	(0.0004)	(0.0004)
	Absolute gap	*0.0464****	*0.0401****	*0.0343****	*0.0290****	*0.0245****	*0.0205****	*0.0171****	*0.0143****	*0.0119****
	Relative gap	*1.36*	*1.44*	*1.53*	*1.62*	*1.72*	*1.83*	*1.93*	*2.04*	*2.15*

Notes: Survey weights used; standard errors (in parentheses) were estimated following the bootstrap estimate of the standard error proposed by Bradley Efron with 1000 stratified bootstrap replications (Efron, 1981, p. 139-143). *Significance levels:* *p < 0.1; **p < 0.05; ***p < 0.01.

Table 4.A.8: Multidimensional poverty by gender in Central America as a whole, for each of the three scenarios and various degrees of inequality aversion.
Source: Authors' estimates based on GUA-ENCOVI2014, ELS-EHPM2016, HON-EPHPM2013, NIC-EMNV2014, and CR-ENAHO2016.

Panel I: Scenario 1

	Male		Female		Sex ratio	
Gamma	**MPI**	**SE**	**MPI**	**SE**	**Absolute**	**Relative**
0.00	0.2849	0.0009	0.2688	0.0008	-0.0161***	0.94
0.25	0.2305	0.0009	0.2145	0.0008	-0.0160***	0.93
0.50	0.1893	0.0008	0.1737	0.0007	-0.0155***	0.92
0.75	0.1575	0.0008	0.1426	0.0006	-0.0149***	0.91
1.00	0.1326	0.0007	0.1184	0.0006	-0.0142***	0.89
1.25	0.1128	0.0007	0.0992	0.0006	-0.0136***	0.88
1.50	0.0969	0.0007	0.0840	0.0005	-0.0129***	0.87
1.75	0.0838	0.0006	0.0717	0.0005	-0.0121***	0.86
2.00	0.0732	0.0006	0.0617	0.0005	-0.0115***	0.84

Panel II: Scenario 2

	Male		Female		Sex ratio	
Gamma	**MPI**	**SE**	**MPI**	**SE**	**Absolute**	**Relative**
0.00	0.2858	0.0009	0.2981	0.0009	0.0124***	1.04
0.25	0.2313	0.0009	0.2425	0.0009	0.0112***	1.05
0.50	0.1900	0.0008	0.2002	0.0008	0.0101***	1.05
0.75	0.1582	0.0008	0.1674	0.0007	0.0092***	1.06
1.00	0.1332	0.0007	0.1416	0.0007	0.0084***	1.06
1.25	0.1133	0.0007	0.1210	0.0007	0.0077***	1.07
1.50	0.0973	0.0007	0.1044	0.0007	0.0071***	1.07
1.75	0.0843	0.0006	0.0909	0.0006	0.0066***	1.08
2.00	0.0736	0.0006	0.0797	0.0006	0.0062***	1.08

Panel III: Scenario 3

	Male		Female		Sex ratio	
Gamma	**MPI**	**SE**	**MPI**	**SE**	**Absolute**	**Relative**
0.00	0.2867	0.0009	0.3478	0.0010	0.0611***	1.21
0.25	0.2322	0.0009	0.2919	0.0009	0.0597***	1.26
0.50	0.1908	0.0008	0.2485	0.0010	0.0577***	1.30
0.75	0.1588	0.0008	0.2141	0.0009	0.0554***	1.35
1.00	0.1338	0.0007	0.1866	0.0009	0.0528***	1.39
1.25	0.1138	0.0007	0.1641	0.0008	0.0503***	1.44
1.50	0.0978	0.0007	0.1457	0.0008	0.0480***	1.49
1.75	0.0847	0.0007	0.1304	0.0008	0.0457***	1.54
2.00	0.0739	0.0007	0.1175	0.0008	0.0436***	1.59

Notes: Survey weights used; standard errors (in parentheses) were estimated following the bootstrap estimate of the standard error proposed by Bradley Efron with 1000 stratified bootstrap replications (Efron, 1981, p. 139-143). *Significance levels:* *p < 0.1; **p < 0.05; ***p < 0.01.

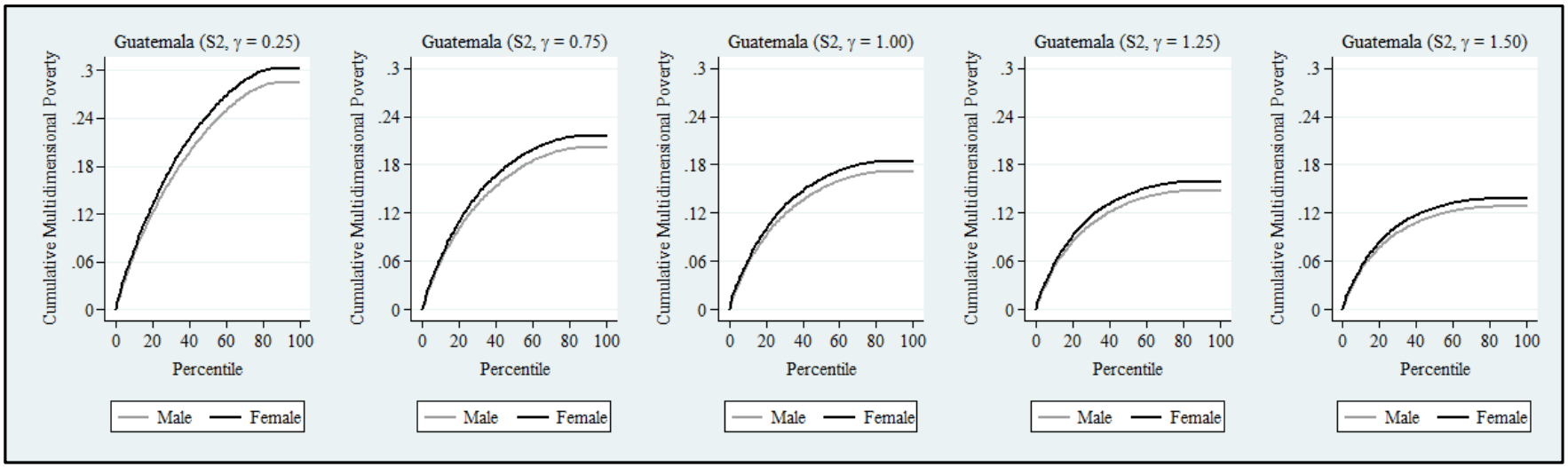

Figure 4.A.1: Cumulative multidimensional poverty among adults in Guatemala by gender and population percentile (the latter ordered from the poorest to the richest).
Source: Authors' estimates based on GUA-ENCOVI2014.
Notes: S2: Scenario 2. In each case, the overall estimated multidimensional poverty corresponds to the height of the curve at the vertical intercept at the 100th percentile. The incidence of multidimensional poverty corresponds to the length of the non-horizontal section of the curve (the percentile at which the curve becomes horizontal). The average multidimensional poverty among the poor is equal to the slope of the ray from (0, 0) to the point at which the curve becomes horizontal. Inequality among the multi-dimensionally poor individuals is approximated by the degree of concavity of the non-horizontal section of the curve (Jenkins & Lambert, 1997).

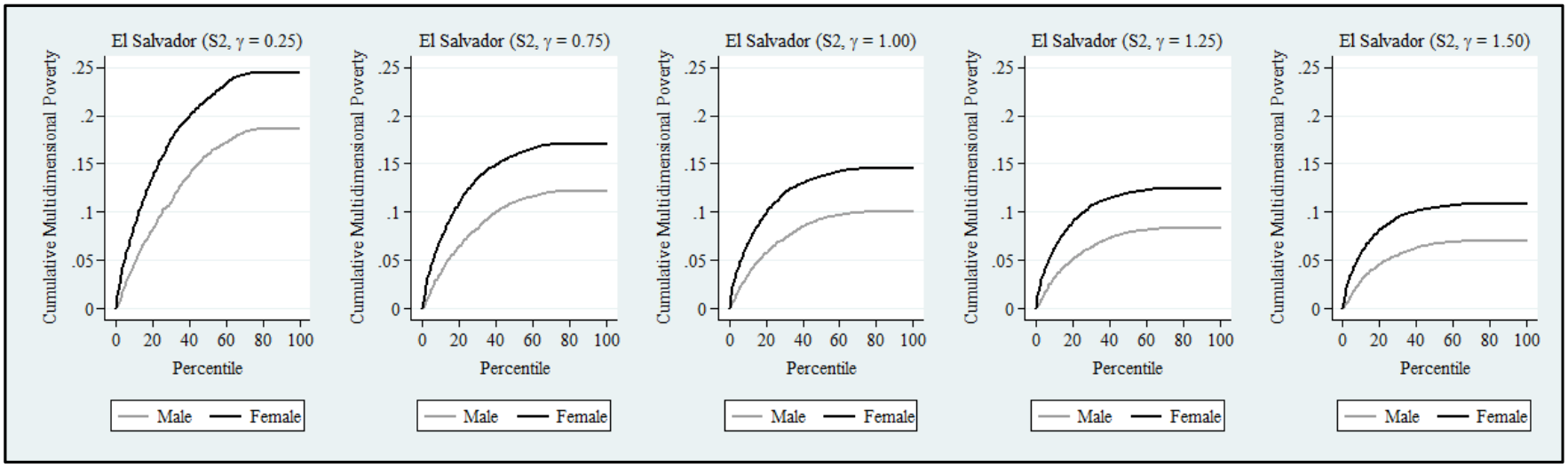

Figure 4.A.2: Cumulative multidimensional poverty among adults in El Salvador by gender and population percentile (the latter ordered from the poorest to the richest).
Source: Authors' estimates based on ELS-EHPM2016.
Notes: S2: Scenario 2. In each case, the overall estimated multidimensional poverty corresponds to the height of the curve at the vertical intercept at the 100th percentile. The incidence of multidimensional poverty corresponds to the length of the non-horizontal section of the curve (the percentile at which the curve becomes horizontal). The average multidimensional poverty among the poor is equal to the slope of the ray from (0, 0) to the point at which the curve becomes horizontal. Inequality among the multi-dimensionally poor individuals is approximated by the degree of concavity of the non-horizontal section of the curve (Jenkins & Lambert, 1997).

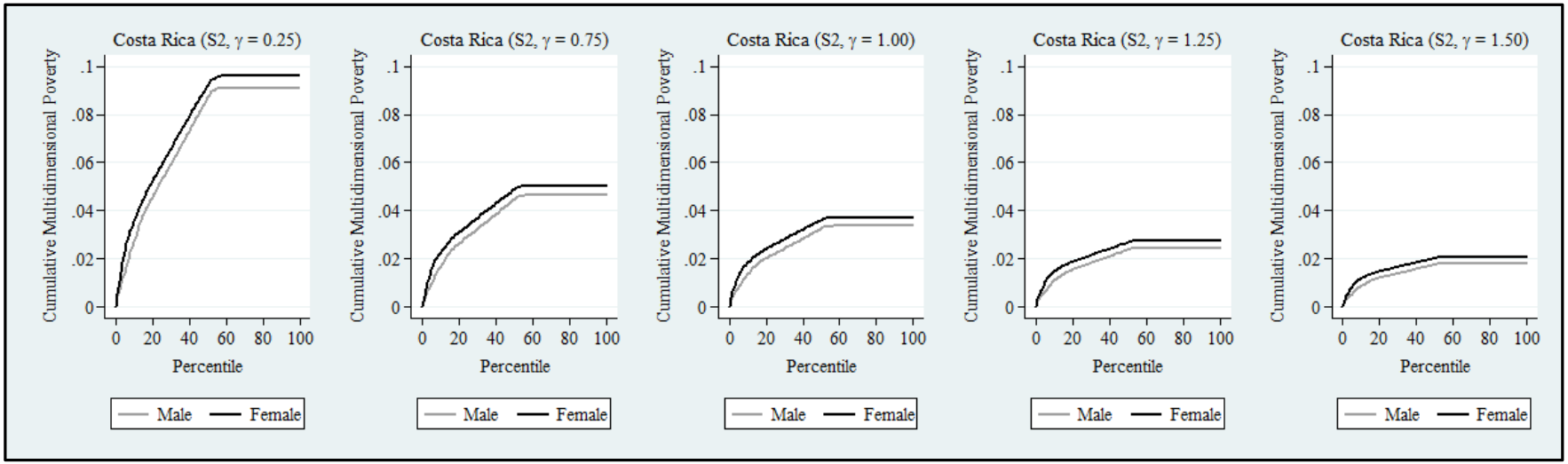

Figure 4.A.3: Cumulative multidimensional poverty among adults in Costa Rica by gender and population percentile (the latter ordered from the poorest to the richest).
Source: Authors' estimates based on CR-ENAHO2016.
Notes: S2: Scenario 2. In each case, the overall estimated multidimensional poverty corresponds to the height of the curve at the vertical intercept at the 100th percentile. The incidence of multidimensional poverty corresponds to the length of the non-horizontal section of the curve (the percentile at which the curve becomes horizontal). The average multidimensional poverty among the poor is equal to the slope of the ray from (0, 0) to the point at which the curve becomes horizontal. Inequality among the multi-dimensionally poor individuals is approximated by the degree of concavity of the non-horizontal section of the curve (Jenkins & Lambert, 1997).

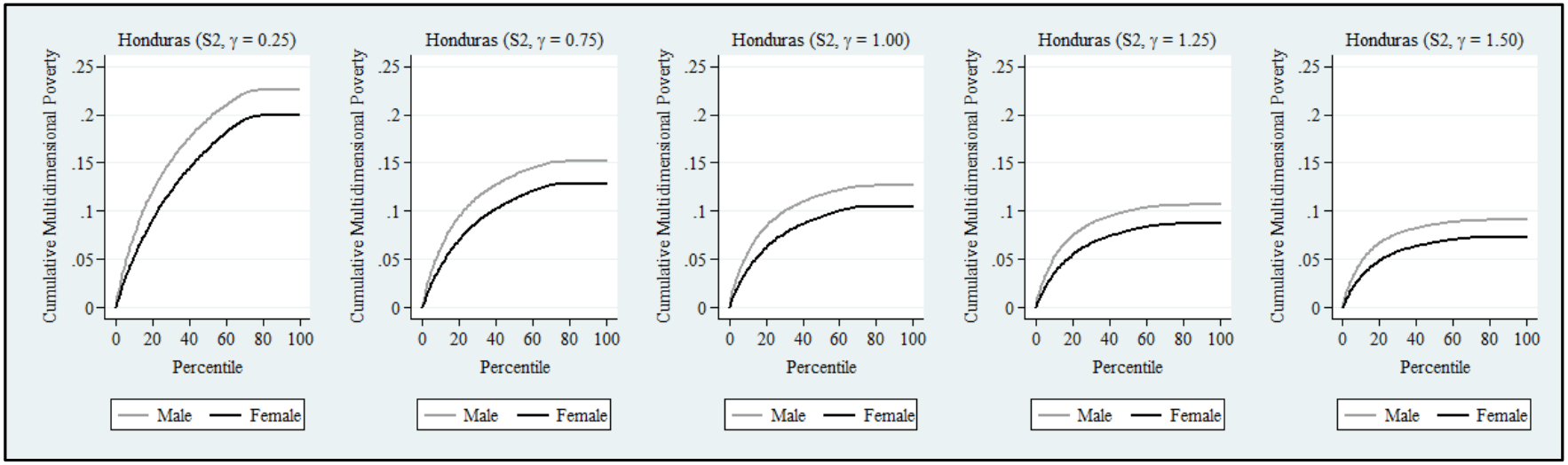

Figure 4.A.4: Cumulative multidimensional poverty among adults in Honduras by gender and population percentile (the latter ordered from the poorest to the richest).
Source: Authors' estimates based on HON-EPHPM2013.
Notes: S2: Scenario 2. In each case, the overall estimated multidimensional poverty corresponds to the height of the curve at the vertical intercept at the 100th percentile. The incidence of multidimensional poverty corresponds to the length of the non-horizontal section of the curve (the percentile at which the curve becomes horizontal). The average multidimensional poverty among the poor is equal to the slope of the ray from (0, 0) to the point at which the curve becomes horizontal. Inequality among the multi-dimensionally poor individuals is approximated by the degree of concavity of the non-horizontal section of the curve (Jenkins & Lambert, 1997).

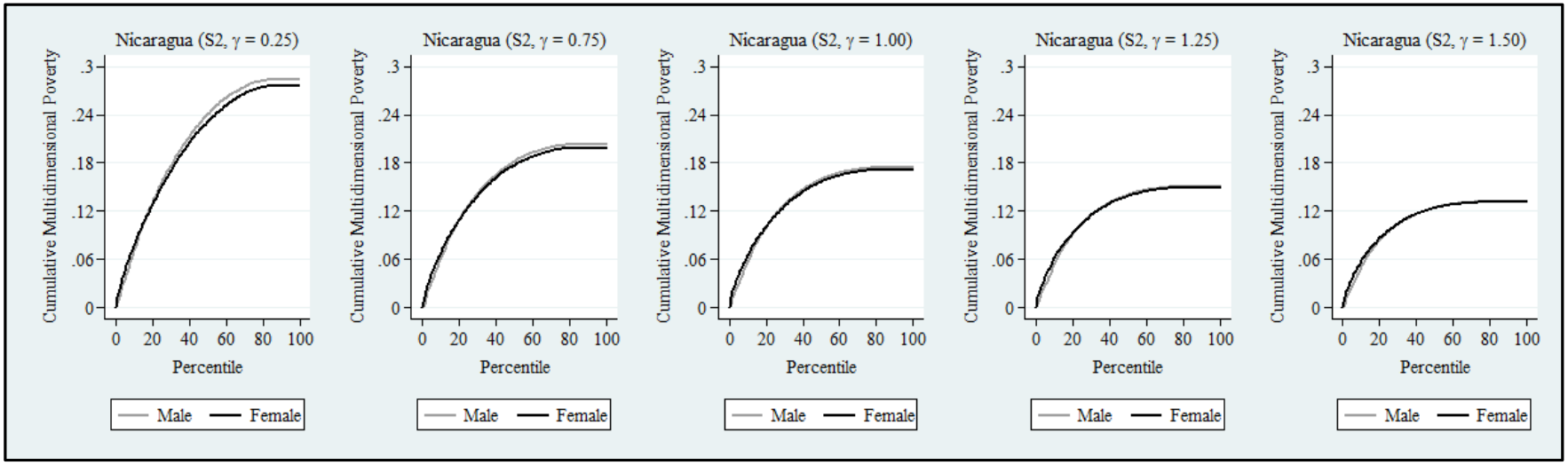

Figure 4.A.5: Cumulative multidimensional poverty among adults in Nicaragua by gender and population percentile (the latter ordered from the poorest to the richest).
Source: Authors' estimates based on NIC-EMNV2014.
Notes: S2: Scenario 2. In each case, the overall estimated multidimensional poverty corresponds to the height of the curve at the vertical intercept at the 100th percentile. The incidence of multidimensional poverty corresponds to the length of the non-horizontal section of the curve (the percentile at which the curve becomes horizontal). The average multidimensional poverty among the poor is equal to the slope of the ray from (0, 0) to the point at which the curve becomes horizontal. Inequality among the multi-dimensionally poor individuals is approximated by the degree of concavity of the non-horizontal section of the curve (Jenkins & Lambert, 1997).

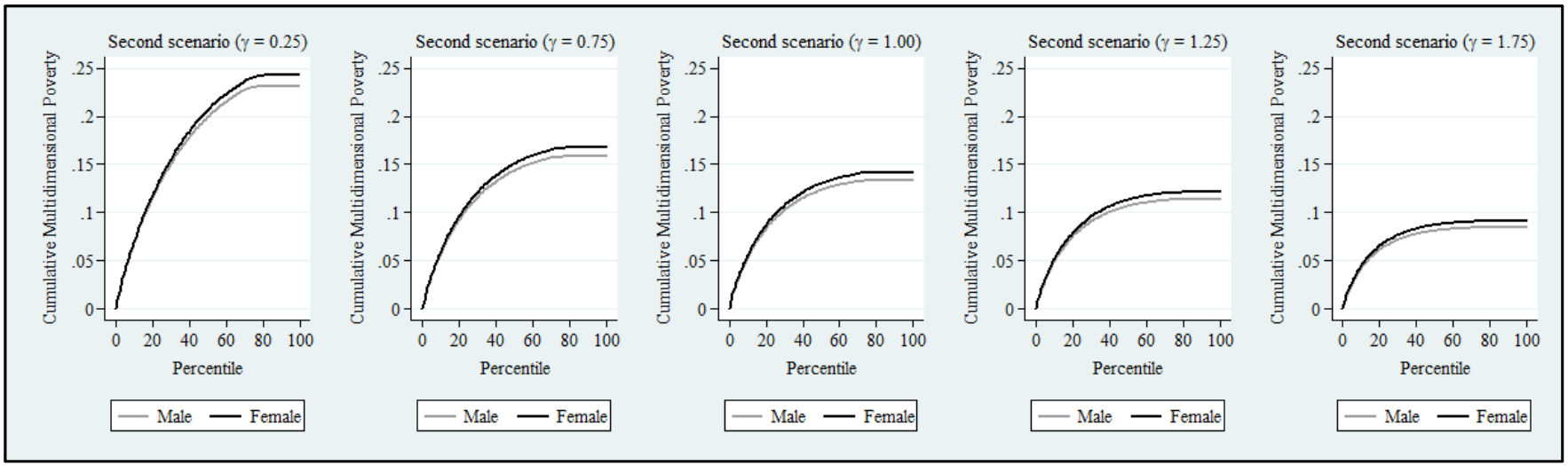

Figure 4.A.6: Cumulative multidimensional poverty among adults in Central America as a whole, by gender and population percentile (the latter ordered from the poorest to the richest).
Source: Authors' estimates based on GUA-ENCOVI2014, ELS-EHPM2016, HON-EPHPM2013, NIC-EMNV2014, and CR-ENAHO2016.
Notes: S2: Scenario 2. In each case, the overall estimated multidimensional poverty corresponds to the height of the curve at the vertical intercept at the 100th percentile. The incidence of multidimensional poverty corresponds to the length of the non-horizontal section of the curve (the percentile at which the curve becomes horizontal). The average multidimensional poverty among the poor is equal to the slope of the ray from (0, 0) to the point at which the curve becomes horizontal. Inequality among the multi-dimensionally poor individuals is approximated by the degree of concavity of the non-horizontal section of the curve (Jenkins & Lambert, 1997).

Table 4.A.9: The three I's of multidimensional poverty by gender in Guatemala (GUA), El Salvador (ELS), Honduras (HON), Nicaragua (NIC), Costa Rica (CR), and Central America (CA) as a whole, and gender differences, considering Scenario 1 and various degrees of inequality aversion.
Source: Authors' estimates based on GUA-ENCOVI2014, ELS-EHPM2016, HON-EPHPM2013, NIC-EMNV2014, and CR-ENAHO2016.

Country	Gender/Gap	Incidence	Intensity	Inequality component: $\{1+[(\gamma+1)^2-(\gamma+1)]\mathrm{GE}_{\gamma+1}(c)\}$ (several values of γ)							
		H (%)	**A (%)**	**0.25**	**0.50**	**0.75**	**1.00**	**1.25**	**1.50**	**1.75**	**2.00**
	Male	89.1	38.6	1.0464	1.1088	1.1879	1.2850	1.4022	1.5421	1.7087	1.9056
	Female	89.7	37.4	1.0425	1.0998	1.1722	1.2605	1.3667	1.4937	1.6434	1.8183
GUA	Absolute gap	*0.60****	*-1.16****	*-0.0038****	*-0.0091****	*-0.0158****	*-0.0245****	*-0.0355****	*-0.0484****	*-0.0653****	*-0.0874****
	Relative gap	*1.01*	*0.97*	*1.00*	*0.99*	*0.99*	*0.98*	*0.97*	*0.97*	*0.96*	*0.95*
	Total	89.4	38.0	1.0444	1.1041	1.1799	1.2724	1.3846	1.5178	1.6763	1.8622
	Male	76.9	30.6	1.0602	1.1428	1.2499	1.3844	1.5511	1.7556	2.0057	2.3117
	Female	76.4	29.8	1.0556	1.1320	1.2310	1.3555	1.5089	1.6975	1.9277	2.2082
ELS	Absolute gap	*-0.45****	*-0.88****	*-0.0046****	*-0.0109****	*-0.0189****	*-0.0289****	*-0.0422****	*-0.0581****	*-0.0779****	*-0.1035****
	Relative gap	*0.99*	*0.97*	*1.00*	*0.99*	*0.98*	*0.98*	*0.97*	*0.97*	*0.96*	*0.96*
	Total	76.6	30.2	1.0578	1.1372	1.2400	1.3693	1.5295	1.7260	1.9658	2.2591
	Male	84.7	33.2	1.0550	1.1300	1.2269	1.3481	1.4975	1.6797	1.9034	2.1737
	Female	82.2	29.6	1.0556	1.1317	1.2298	1.3530	1.5056	1.6939	1.9235	2.2017
HON	Absolute gap	*-2.49****	*-3.57****	*0.0006****	*0.0016****	*0.0029****	*0.0050****	*0.0081****	*0.0142****	*0.0201****	*0.0280****
	Relative gap	*0.97*	*0.89*	*1.00*	*1.00*	*1.00*	*1.00*	*1.01*	*1.01*	*1.01*	*1.01*
	Total	83.3	31.3	1.0559	1.1323	1.2306	1.3548	1.5079	1.6963	1.9274	2.2082
	Male	87.7	38.9	1.0510	1.1193	1.2054	1.3107	1.4373	1.5879	1.7668	1.9765
	Female	85.4	36.1	1.0575	1.1350	1.2336	1.3549	1.5033	1.6813	1.8956	2.1510
NIC	Absolute gap	*-2.28****	*-2.79****	*0.0064****	*0.0157****	*0.0282****	*0.0442****	*0.0660****	*0.0934****	*0.1289****	*0.1745****
	Relative gap	*0.97*	*0.93*	*1.01*	*1.01*	*1.02*	*1.03*	*1.05*	*1.06*	*1.07*	*1.09*
	Total	86.5	37.5	1.0545	1.1274	1.2202	1.3341	1.4719	1.6373	1.8335	2.0661
	Male	57.6	22.4	1.0245	1.0589	1.1042	1.1619	1.2339	1.3240	1.4358	1.5698
	Female	56.6	22.4	1.0272	1.0650	1.1146	1.1774	1.2553	1.3514	1.4683	1.6119
CR	Absolute gap	*-1.03****	*0.04****	*0.0026****	*0.0061****	*0.0103****	*0.0155****	*0.0214****	*0.0273****	*0.0325****	*0.0421****
	Relative gap	*0.98*	*1.00*	*1.00*	*1.01*	*1.01*	*1.01*	*1.02*	*1.02*	*1.02*	*1.03*
	Total	57.0	22.4	1.0259	1.0621	1.1095	1.1699	1.2451	1.3382	1.4518	1.5927
	Male	81.7	34.8	1.0532	1.1258	1.2193	1.3362	1.4796	1.6536	1.8636	2.1172
	Female	81.1	33.2	1.0519	1.1228	1.2141	1.3279	1.4678	1.6379	1.8431	2.0900
CA	Absolute gap	*-0.67****	*-1.69****	*-0.0012****	*-0.0030****	*-0.0052****	*-0.0083****	*-0.0118****	*-0.0156****	*-0.0206****	*-0.0272****
	Relative gap	*0.99*	*0.95*	*1.00*	*1.00*	*1.00*	*0.99*	*0.99*	*0.99*	*0.99*	*0.99*
	Total	81.4	33.9	1.0526	1.1246	1.2172	1.3329	1.4749	1.6475	1.8562	2.1081

Notes: Survey weights used; H: The multidimensional headcount ratio; A: The average deprivation share. *Significance levels:* *p < 0.1; **p < 0.05; ***p < 0.01.

Table 4.A.10: The three I's of multidimensional poverty by gender in Guatemala (GUA), El Salvador (ELS), Honduras (HON), Nicaragua (NIC), Costa Rica (CR), and Central America (CA) as a whole, and gender differences, considering Scenario 2 and various degrees of inequality aversion.
Source: Authors' estimates based on GUA-ENCOVI2014, ELS-EHPM2016, HON-EPHPM2013, NIC-EMNV2014, and CR-ENAHO2016.

Country	Gender/Gap	Incidence	Intensity	Inequality component: $\{1+[(\gamma+1)^2-(\gamma+1)]\mathrm{GE}_{\gamma+1}(c)\}$ (several values of γ)							
		H (%)	**A (%)**	**0.25**	**0.50**	**0.75**	**1.00**	**1.25**	**1.50**	**1.75**	**2.00**
	Male	89.1	38.7	1.0461	1.1082	1.1867	1.2830	1.4001	1.5392	1.7048	1.8998
	Female	90.7	40.3	1.0408	1.0960	1.1659	1.2519	1.3555	1.4785	1.6244	1.7960
GUA	Absolute gap	*1.58****	*1.53****	*-0.0053****	*-0.0122****	*-0.0208****	*-0.0310****	*-0.0446****	*-0.0607****	*-0.0805****	*-0.1038****
	Relative gap	*1.02*	*1.04*	*0.99*	*0.99*	*0.98*	*0.98*	*0.97*	*0.96*	*0.95*	*0.95*
	Total	89.9	39.6	1.0433	1.1015	1.1756	1.2661	1.3755	1.5063	1.6607	1.8430
	Male	76.9	30.7	1.0602	1.1425	1.2495	1.3837	1.5501	1.7542	2.0034	2.3087
	Female	82.1	36.4	1.0520	1.1233	1.2154	1.3305	1.4721	1.6445	1.8530	2.1041
ELS	Absolute gap	*5.22****	*5.74****	*-0.0082****	*-0.0192****	*-0.0341****	*-0.0531****	*-0.0780****	*-0.1097****	*-0.1504****	*-0.2046****
	Relative gap	*1.07*	*1.19*	*0.99*	*0.98*	*0.97*	*0.96*	*0.95*	*0.94*	*0.92*	*0.91*
	Total	79.8	33.9	1.0563	1.1335	1.2334	1.3591	1.5142	1.7035	1.9347	2.2155
	Male	84.9	33.3	1.0545	1.1288	1.2246	1.3445	1.4923	1.6742	1.8940	2.1614
	Female	83.0	30.7	1.0545	1.1290	1.2255	1.3467	1.4979	1.6833	1.9114	2.1891
HON	Absolute gap	*-1.92****	*-2.63****	*0.0001*	*0.0002***	*0.0009****	*0.0021****	*0.0057****	*0.0091****	*0.0175****	*0.0277****
	Relative gap	*0.98*	*0.92*	*1.00*	*1.00*	*1.00*	*1.00*	*1.00*	*1.01*	*1.01*	*1.01*
	Total	83.9	31.9	1.0548	1.1297	1.2266	1.3482	1.4986	1.6842	1.9096	2.1858
	Male	87.8	38.9	1.0508	1.1187	1.2046	1.3096	1.4355	1.5861	1.7637	1.9737
	Female	86.4	38.4	1.0558	1.1311	1.2275	1.3460	1.4907	1.6653	1.8760	2.1241
NIC	Absolute gap	*-1.39****	*-0.53****	*0.0050****	*0.0125****	*0.0229****	*0.0364****	*0.0551****	*0.0792****	*0.1123****	*0.1504****
	Relative gap	*0.98*	*0.99*	*1.00*	*1.01*	*1.02*	*1.03*	*1.04*	*1.05*	*1.06*	*1.08*
	Total	87.0	38.6	1.0535	1.1253	1.2166	1.3286	1.4645	1.6270	1.8216	2.0521
	Male	57.6	22.4	1.0247	1.0592	1.1048	1.1626	1.2351	1.3249	1.4366	1.5729
	Female	57.8	23.2	1.0286	1.0689	1.1217	1.1885	1.2721	1.3745	1.4998	1.6522
CR	Absolute gap	*0.18****	*0.80****	*0.0040****	*0.0097****	*0.0169****	*0.0259****	*0.0370****	*0.0496****	*0.0633****	*0.0793****
	Relative gap	*1.00*	*1.04*	*1.00*	*1.01*	*1.02*	*1.02*	*1.03*	*1.04*	*1.04*	*1.05*
	Total	57.7	22.8	1.0268	1.0645	1.1140	1.1769	1.2558	1.3529	1.4721	1.6181
	Male	81.8	34.9	1.0529	1.1252	1.2183	1.3343	1.4769	1.6501	1.8596	2.1109
	Female	82.9	36.0	1.0505	1.1197	1.2089	1.3204	1.4574	1.6235	1.8248	2.0662
CA	Absolute gap	*1.04****	*1.05****	*-0.0024****	*-0.0055****	*-0.0095****	*-0.0140****	*-0.0195****	*-0.0266****	*-0.0349****	*-0.0447****
	Relative gap	*1.01*	*1.03*	*1.00*	*1.00*	*0.99*	*0.99*	*0.99*	*0.98*	*0.98*	*0.98*
	Total	82.4	35.5	1.0517	1.1223	1.2133	1.3270	1.4666	1.6361	1.8409	2.0874

Notes: Survey weights used; H: The multidimensional headcount ratio; A: The average deprivation share. *Significance levels:* *p < 0.1; **p < 0.05; ***p < 0.01.

Table 4.A.11: The three I's of multidimensional poverty by gender in Guatemala (GUA), El Salvador (ELS), Honduras (HON), Nicaragua (NIC), Costa Rica (CR), and Central America (CA) as a whole, and gender differences, considering Scenario 3 and various degrees of inequality aversion.
Source: Authors' estimates based on GUA-ENCOVI2014, ELS-EHPM2016, HON-EPHPM2013, NIC-EMNV2014, and CR-ENAHO2016.

Country	Gender/Gap	Incidence	Intensity	Inequality component: $\{1+[(\gamma+1)^2-(\gamma+1)]\mathrm{GE}_{\gamma+1}(c)\}$ (several values of γ)							
		H (%)	**A (%)**	**0.25**	**0.50**	**0.75**	**1.00**	**1.25**	**1.50**	**1.75**	**2.00**
	Male	89.2	38.9	1.0459	1.1076	1.1859	1.2821	1.3976	1.5360	1.7007	1.8948
	Female	92.5	47.6	1.0390	1.0913	1.1570	1.2367	1.3316	1.4438	1.5744	1.7266
GUA	Absolute gap	*3.36****	*8.78****	*-0.0068****	*-0.0163****	*-0.0289****	*-0.0454****	*-0.0660****	*-0.0923****	*-0.1264*	*-0.1682****
	Relative gap	*1.04*	*1.23*	*0.99*	*0.99*	*0.98*	*0.96*	*0.95*	*0.94*	*0.93*	*0.91*
	Total	91.0	43.6	1.0434	1.1017	1.1754	1.2655	1.3739	1.5026	1.6539	1.8322
	Male	76.9	30.7	1.0602	1.1425	1.2495	1.3837	1.5501	1.7542	2.0034	2.3087
	Female	82.1	36.4	1.0520	1.1233	1.2154	1.3305	1.4721	1.6445	1.8530	2.1041
ELS	Absolute gap	*5.22****	*5.74****	*-0.0082****	*-0.0192****	*-0.0341****	*-0.0531****	*-0.0780****	*-0.1097****	*-0.1504****	*-0.2046****
	Relative gap	*1.07*	*1.19*	*0.99*	*0.98*	*0.97*	*0.96*	*0.95*	*0.94*	*0.92*	*0.91*
	Total	79.8	33.9	1.0563	1.1335	1.2335	1.3590	1.5140	1.7036	1.9343	2.2148
	Male	85.2	33.3	1.0542	1.1282	1.2234	1.3429	1.4902	1.6705	1.8898	2.1558
	Female	85.4	35.5	1.0532	1.1261	1.2207	1.3391	1.4857	1.6649	1.8833	2.1486
HON	Absolute gap	*0.28****	*2.18****	*-0.0010****	*-0.0021****	*-0.0028****	*-0.0039****	*-0.0044****	*-0.0056****	*-0.0064****	*-0.0073****
	Relative gap	*1.00*	*1.07*	*1.00*	*1.00*	*1.00*	*1.00*	*1.00*	*1.00*	*1.00*	*1.00*
	Total	85.3	34.5	1.0538	1.1274	1.2226	1.3423	1.4898	1.6706	1.8914	2.1582
	Male	87.8	39.0	1.0506	1.1183	1.2037	1.3080	1.4331	1.5831	1.7601	1.9678
	Female	88.5	43.2	1.0547	1.1288	1.2230	1.3393	1.4807	1.6508	1.8542	2.0956
NIC	Absolute gap	*0.72****	*4.20****	*0.0041****	*0.0105****	*0.0193****	*0.0313****	*0.0475****	*0.0678****	*0.0941****	*0.1278****
	Relative gap	*1.01*	*1.11*	*1.00*	*1.01*	*1.02*	*1.02*	*1.03*	*1.04*	*1.05*	*1.06*
	Total	88.2	41.2	1.0534	1.1254	1.2168	1.3298	1.4667	1.6310	1.8268	2.0620
	Male	57.8	22.5	1.0248	1.0595	1.1053	1.1635	1.2367	1.3264	1.4403	1.5757
	Female	64.0	27.6	1.0315	1.0751	1.1315	1.2016	1.2872	1.3901	1.5131	1.6578
CR	Absolute gap	*6.21****	*5.10****	*0.0066****	*0.0156****	*0.0263****	*0.0381****	*0.0504****	*0.0637****	*0.0729****	*0.0821****
	Relative gap	*1.11*	*1.23*	*1.01*	*1.01*	*1.02*	*1.03*	*1.04*	*1.05*	*1.05*	*1.05*
	Total	61.0	25.2	1.0305	1.0732	1.1292	1.2000	1.2878	1.3950	1.5246	1.6819
	Male	81.9	35.0	1.0527	1.1248	1.2175	1.3334	1.4753	1.6477	1.8559	2.1069
	Female	85.1	40.8	1.0498	1.1177	1.2048	1.3130	1.4453	1.6044	1.7954	2.0238
CA	Absolute gap	*3.20****	*5.86****	*-0.0030****	*-0.0071****	*-0.0127****	*-0.0204****	*-0.0300****	*-0.0433****	*-0.0604****	*-0.0830****
	Relative gap	*1.04*	*1.17*	*1.00*	*0.99*	*0.99*	*0.98*	*0.98*	*0.97*	*0.97*	*0.96*
	Total	83.6	38.2	1.0519	1.1230	1.2145	1.3286	1.4684	1.6383	1.8429	2.0885

Notes: Survey weights used; H: The multidimensional headcount ratio; A: The average deprivation share. *Significance levels:* *p < 0.1; **p < 0.05; ***p < 0.01.

5. Monitoring progress in multidimensional poverty reduction: a person-focused and inequality-sensitive approach with evidence from Nicaragua[89]

Abstract

In this essay, considering the overarching concern of the 2030 sustainable development agenda, leaving no one behind, and the targets 1.2 and 10.1 of the SDGs, we point out, again, that the mainstream approach to the multidimensional poverty measurement in developing countries is deficient to properly monitor progress in multidimensional poverty reduction, mainly because it uses the household as the unit of analysis, ignoring thus intra-household inequalities, and is totally insensitive to inequality among the multi-dimensionally poor individuals, a serious defect of any poverty measure. Consequently, based on the discussion in the previous essay, we propose to depart somewhat from the mainstream approach and to adopt a person-focused and inequality-sensitive framework, which is applied to the case of Nicaragua. To the best of our knowledge, this is the first attempt in the literature on multidimensional poverty analysis that evaluates progress in multidimensional poverty reduction across the whole population by using a person-focused and inequality-sensitive framework. Overall, we find that in this country, multidimensional poverty decreased by at least 17% between 2001 and 2014, but inequality among the multi-dimensionally poor individuals, an issue that is ignored by the mainstream approach, increased by at least 24% during that period; that is, people's deprivation scores were less unequally distributed in 2001 than in 2014, which suggests that progress in multidimensional poverty reduction in Nicaragua seems to be leaving behind the poorest of the poor, challenging thus the overarching concern of the SDGs agenda.

[89] This essay complements empirically the previous essay (Section 4 of this dissertation) and attempts to emphasize, again, the necessity of departing somewhat from the mainstream approach to the measurement of multidimensional poverty in developing countries, considering, particularly, the central overarching concern of the 2030 sustainable development agenda, leaving no one behind, and Targets 1.2 and 10.1 of the SDGs. We would like to thank Nicole Rippin for clarifications and useful discussions on the Correlation Sensitive Poverty Index, and Stephan Klasen, Julio López-Laborda, and Jacques Silber for helpful comments on the topic. José Espinoza-Delgado would also like to acknowledge financial support by the German Academic Exchange Service.

5.1. Introduction

The 2018 global multidimensional poverty index (global MPI) reveals that about 1.3 billion individuals globally live in multidimensional poverty; it also shows that 83% of the multi-dimensionally poor in the world live in Sub-Saharan Africa and South Asia and 50% of them are children (OPHI, 2018). Therefore, the elimination of poverty has been and will remain one of the major international development policies for a large number of people in the world, even in the second decade of the twenty-first century (Chakravarty, 2018; Chakravarty & Silber, 2008); it is actually "the greatest global challenge and an indispensable requirement for sustainable development" (UN, 2017, p. 1). In this regard, the 2030 Agenda for Sustainable Development, a normative framework with international consensus, which was passed in 2015, has put particular emphasis on this issue (UN, 2015b), and Goal 1 of the Sustainable Development Goals (SDGs) demands the ending of "poverty in all its forms everywhere" (UN, 2015b, p. 15). In this context, the measurement of poverty, our central concern in this paper, is of great importance for targeting and monitoring of poverty alleviation policies; it is, as noted by Deaton (2016, p. 1221), necessary if not sufficient for any reasoned appraisal of these policies.

Over the last decade or so, poverty measurement has shifted the emphasis from a unidimensional to a multidimensional approach (Datt, 2018; Pogge & Wisor, 2016), due in large part to Sen's influential work (see, for instance, Sen, 1985, 1992, 1997, 2000a, 2010). Currently, the dominating (mainstream) approach in developing countries is the counting methodology put forward by Alkire and Foster (2011a) (henceforth AF) (Datt, 2018; Duclos & Tiberti, 2016; Espinoza-Delgado & Silber, 2018), largely due to the extraordinary work done at the Oxford Poverty and Human Development Initiative (OPHI).[90] In 2010, OPHI, in collaboration with the United Nations Development Program (UNDP), developed the global MPI, which is a particular case ["the adjusted headcount ratio (M_0)"] of the AF family of multidimensional poverty measures (Alkire & Foster, 2011, p. 479), the most famous and influential empirical application of the AF methodology, computed for over 100 developing countries (see Alkire & Santos, 2010, 2014). Since 2010, the global MPI has been incorporated into the Human Development Report of the UNDP (UNDP, 2010) and is beginning to be seen as a "serious competitor to the World Bank's $1.90-a-day monetary poverty indicator" (Klasen, 2018, p. 2); further, a new version of the global MPI that

[90] See [online] https://ophi.org.uk/

considers improvements for some indicators has been proposed to monitor progress toward the SDGs and in achieving Goal 1 of these (OPHI, 2015; Alkire & Jahan, 2018). The AF approach (the M_0 measure) has also been adopted by several countries, particularly from Latin America and the Caribbean, to produce their official multidimensional poverty measures;[91] likewise, Santos and Villatoro (2018) have recently developed a new multidimensional poverty index for Latin America (MPI-LA) that follows the same functional form as the global MPI (the M_0 measure).

As discussed in this dissertation, the AF approach, and therefore its M_0 measure, has quite a nice number of interesting properties (see Alkire & Foster, 2011; Alkire, Foster, Seth, Santos, Roche, & Ballón, 2015), in addition to the fact that it has the advantage of flexibility, simplicity, and clarity, when compared to other multidimensional poverty methodologies (Espinoza-Delgado & Silber, 2018; Thorbecke, 2011).[92] However, this methodology (M_0 measure) suffers from several unattractive methodological features that have not yet been sufficiently observed in the literature, as discussed by Duclos and Tiberti (2016), which may lead to biased estimates and wrong assessments of overall multidimensional poverty in the society.

Firstly, since the AF methodology employs a "dual cutoff method" for the identification of the multi-dimensionally poor individuals (Alkire & Foster, 2011, p. 478), a first cutoff within each dimension (indicator) to determine whether an individual is deprived in that dimension (indicator), and a second cutoff, or multidimensional poverty line (k), across dimensions (indicators) that identifies the multi-dimensionally poor by counting the dimensions (indicators) in which an individual is deprived, the AF identification function is discrete, creates two types of discontinuities, and thus violates the axiom of continuity (Duclos & Tiberti, 2016). Although when using ordinal variables (dimensions or indicators), the commonest case, the first discontinuity can be considered as irrelevant, the discontinuity created by the second cutoff (k) can be of great relevance for multidimensional poverty measurement: a small variation in k can change from 0 to 1, or from 1 to 0, the contribution of any person to overall poverty, which "may penalize welfare-equalizing policies and

[91] For example: Chile (Ministerio de Desarrollo Social, 2016), Colombia (DANE-DIMPE, 2014), Costa Rica (INEC-CR, 2015), Ecuador (Castillo & Jácome, 2015), El Salvador (STPP & MINEC-DIGESTYC, 2015), Honduras (SCGG-INE, 2016), México (CONEVAL, 2011), and Panamá (MEF, 2017).

[92] Other methodologies can be found, for instance, in Alkire et al. (2015); Lemmi and Betti (2006, 2013); Kakwani and Silber (2008).

development processes" (Duclos & Tiberti, 2016, p. 696). Additionally, as noted by Rippin (2017, p. 37), the dual cutoff identification method assumes implicitly that up to k the dimensions (indicators) are "perfect substitutes", whereas the same dimensions (indicators) are "perfect complements" from such a threshold onwards, an issue theoretically questionable.

Secondly, the M_0 index pays no attention to the distribution of deprivations; it is thus totally insensitive to inequality among the multi-dimensionally poor individuals (actually any measure grounded on the AF methodology) (Datt, 2018; Rippin, 2013, 2017), a serious shortcoming of any poverty measure, according to Sen's (1976, 1979, 1992) influential arguments that overall poverty indices should be sensitive to inequality, which may lead to leaving behind the poorest of the poor: an inequality insensitive poverty measure "can deflect anti-poverty policy by ignoring the greater misery of the poorer among the poor" (Sen, 1992, p. 105). Note also that Goal 10 of the SDGs calls for reducing "inequality within and among countries" (UN, 2015b, p. 21). Formally, as observed by Rippin (2017, p. 47), this index (and actually any AF index), due to the dual cutoff approach, does not fulfill the strongest and the weakest versions of the axiom of "Sensitivity to Inequality Increasing Switch (SIIS)", which is also supposed to capture the interaction between allocation efficiency and distributive justice (see Sen, 1992).[93] For example, an inequality increasing switch that lessens the weighted deprivation score of the less multi-dimensionally poor person below the multidimensional poverty line (k) will always lead to a reduction of the multidimensional poverty rates, regardless of the relationship between dimensions (indicators) (Rippin, 2017); accordingly, this weakness may lead to biased assessments of the extent of multidimensional poverty and hence have an impact on antipoverty programs, and targeting (Espinoza-Delgado & Silber, 2018).

With regard to applied work, another feature of the mainstream practice of the multidimensional poverty measurement (and really of the vast majority of studies on multidimensional poverty) is the fact that it uses the household rather than the individual as the unit of analysis (Espinoza-Delgado & Klasen, 2018; Vijaya, Lahoti, & Swaminathan,

[93] As observed by Rippin (2017, p. 33-34): "Poverty measures can even decrease in the face of increasing inequality if and only if the degree of complementarity between poverty dimensions is so strong that the gains in allocation efficiency outweigh the sacrifices on the side of distributional justice. In other words, changes in poverty measures ought not to be reduced to considerations of who gains and who loses from redistributions (distributive justice) but should also take into account how efficient resources are distributed among the poor (allocation efficiency)".

2014); this means that it considers equal the multidimensional poverty condition of the household with the multidimensional poverty condition of all persons belonging to the household, ignoring, therefore, intra-household inequalities[94] and producing indexes that are insensitive to gender (Bessell, 2015; Espinoza-Delgado & Klasen, 2018; Pogge & Wisor, 2016). As observed by Deaton (1997, p. 223), poverty is a feature of individuals, not households, and "if one is serious about what should be the ultimate object of welfare analysis–that is, the welfare of *individuals*–then limiting the theoretical and empirical analysis at the level of the household is simply unacceptable" (Chiappori, 2016, p. 840). Household-based measures may provide biased estimates of the extent of multidimensional poverty in aggregate: for example, if females are systematically poorer than males, or if children and elderly are systematically worse-off than other household members, overall poverty may be understated when one employs a measure that treats everybody in the household equally (Deaton, 1997); furthermore, when these measures are used, valuable information about the composition of the multi-dimensionally poor may be overlooked (Jenkins, 1991), which may thus affect targeting and effectiveness of poverty alleviation policies (see, for example, Brown, Ravallion, & van de Walle, 2018). Hence, household-based multidimensional poverty measures are "unreliable at best, and deeply flawed at worst" (Chiappori & Meghir, 2015, p. 1371), and these are not suitable to monitor progress in achieving target 1.2 of the SDGs: "By 2030, reduce at least by half the proportion of men, women and children of all ages living in poverty in all its dimensions according to national definitions" (UN, 2015b, p. 15); the poverty analysis should therefore be moved from the household to the individual (Espinoza-Delgado & Klasen, 2018; Vijaya et al., 2014).

In consequence, in this paper, we emphasize the adoption of a person-focused and inequality-sensitive approach to monitoring progress in multidimensional poverty reduction in developing countries in the context of Goal 1 of the SDGs and in line with the central overarching concern of the SDGs agenda: Leaving no one behind (Klasen & Fleurbaey, 2018); that is, we point out an approach that departs somehow from the mainstream multidimensional poverty analysis. We follow the approach proposed in the preceding chapter, which is based on the general framework proposed by Silber and Yalonetzky (2014) and the methodology, with ordinal (dichotomized) dimensions (variables), developed by Rippin (2013, 2014); as discussed, this approach uses a "fuzzy" identification function and a

[94] See, for instance, Asfaw, Klasen, and Lamanna (2010); Bradshaw, Chant, and Linneker (2018); Chant (2008); Klasen and Wink (2002, 2003); Rodríguez (2016).

class of multidimensional poverty measures that take into account efficiency and distributive considerations and can be decomposed into the three "dimensions" of poverty: incidence, intensity, and inequality (Jenkins & Lambert, 1997, p. 317). We apply such an approach to assess the progress in multidimensional poverty reduction in Nicaragua between 2001 and 2014, which empirically complement Chapter 4 of this dissertation. Nicaragua is an interesting study case because it is the multi-dimensionally poorest country in Latin America (Santos & Villatoro, 2018) and the only country in Central America that has not yet adopted officially a multidimensional poverty approach. To the best of our knowledge, this is the first attempt in the literature on multidimensional poverty analysis to evaluate progress in multidimensional poverty reduction across the whole population by using a person-focused and inequality-sensitive framework.

5.2. An inequality-sensitive framework for multidimensional poverty measurement

In this essay, we follow the framework proposed by Espinoza-Delgado and Silber (2018), which is based on the work by Silber and Yalonetzky (2014) and on Rippin's (2013, 2017) methodology with ordinal (dichotomized) variables, and it is described in the previous chapter of this dissertation. This framework entails two stages: 1) The construction of an individual multidimensional poverty function, which comprises an identification function and a function defining the multidimensional poverty breadth; and 2) the construction of a social multidimensional poverty function by aggregating the individual multidimensional poverty functions. Below, we describe briefly the framework to be applied.

Before describing the stages of the framework to be used in the essay, let us first introduce some notations and definitions.

Let $\mathbf{N} = \{1, \dots, n\} \subset \mathbb{N}$ represent the set of n individuals, and let $\mathbf{D} = \{1, \dots, d\} \subset \mathbb{N}$ denote the set of d ordinal variables (dimensions or indicators) measuring different aspects of person's well-being. Let $\mathbf{X} = [x_{ij}]$ be the $n \times d$ achievement matrix, where x_{ij} $(\in \mathbb{N}_{++})$ represents the attainment of the i^{th} person for the jth variable (dimension or indicator). In this matrix, each row vector $\mathbf{x}_{i.} = (x_{i1}, \dots, x_{id})$ gives the attainments of the i^{th} person, while each column vector $\mathbf{x}_{.j} = (x_{1j}, \dots, x_{nj})$ provides the distribution of the j^{th} variable across the whole population. Let $\mathbf{z} = (z_1, \dots, z_d)$ be a row vector defining the variable-specific deprivation

lines and $\mathbf{w} = (w_1, \ldots, w_d)$ the vector of variable-specific weights, with $w_j > 0 \; \forall j \in [1, d]$ and $\sum_{j=1}^{d} w_j = 1$. Finally k indicates the real-valued scalar cutoff, with $0 \leq k \leq 1$; it is the minimal deprivation score a person needs to obtain in order to be identified as multi-dimensionally poor.

5.2.1. The function that accounts for individual multidimensional poverty

Two sequential steps are involved in constructing the individual multidimensional poverty function. The first step assesses whether a person is deprived in each variable j by comparing the person's achievement (x_{ij}) with the defined deprivation threshold (z_j): if $x_{ij} < z_j$, person i is deemed to be deprived in variable j. By combining $\mathbf{X} = [x_{ij}]$ and $\mathbf{z} = (z_1, \ldots, z_d)$, a (0-1)-matrix $\mathbf{g^0}[g_{ij}^0]$ is obtained, such that $g_{ij}^0 = 1$ if $x_{ij} < z_j$, and $g_{ij}^0 = 0$ if $x_{ij} \geq z_j$, for all $j = 1, \ldots, d$ and for $i = 1, \ldots, n$. Then, a weighted deprivations score $[c_i(x_i; z; w)]$, "the real-valued counting function", is calculated for each person as the weighted sum of the deprivations suffered by each of them (Silber & Yalonetzky, 2014, p. 11). If person i does not suffer from any deprivation, $c_i(x_i; z; w) = 0$; conversely, if they are deprived in all the variables considered in the analysis $c_i(x_i; z; w) = 1$.

The second step is concerned with the identification of the multi-dimensionally poor individuals; generally speaking, under this step, the real-valued counting function $[c_i(x_i; z; w)]$ is compared with the multidimensional poverty line (k): if the former is greater or equal to the latter, then person i is regarded as multi-dimensionally poor; this step requires, therefore, the choice of an identification function to determine who is multi-dimensionally poor and who is not. There are, basically, two type of identification functions: discrete identification functions, which dichotomize (0-1) the distribution of weighted deprivations scores (e.g., the one used by the AF methodology), considering the previous condition, and "fuzzy" identification functions, which differentiate between the multi-dimensionally non-poor individuals, on the one hand, and different degrees of multidimensional poverty severity among the remaining individuals, on the other hand (Rippin, 2017, p. 42); in other words, this second type of identification functions considers multidimensional poverty as a "matter of degree" rather than an all or nothing state (Betti, Cheli, Lemmi, & Verma, 2008, p. 30), avoiding thus the discontinuity created by the other type of identification function.

Particularly, as discussed in the introduction, in this essay, as opposed to the mainstream approach to the measurement of multidimensional poverty in the developing world, we employ a fuzzy identification function that makes explicit the relationship between the ordinal variables considered in the assessment and does not cause a discontinuity in the distribution of weighted deprivations scores. This function has been proposed by Rippin (2013, 2017) and is defined as

$$\psi^{\text{fuzzy}}(x_i; z; w; k) = [c_i(x_i; z; w)]^{\gamma} \quad (1)$$

where $[c_i(x_i; z; w)]^{\gamma}$ satisfies the conditions of being non-decreasing in $c_i(x_i; z; w)$ and of having a non-decreasing (non-increasing) marginal if the variables are assumed to be substitutes (complements).[95] Note that the overall form of the fuzzy identification function is conditioned to the value of the parameter gamma (γ), which can be interpreted as an indicator of "inequality aversion" (Rippin, 2013, p. 27); it can be concave, if the parameter gamma is between 0 and 1, or can be convex, if gamma is higher than 1. The first case corresponds to the case when the variables are considered as complements, while the second one corresponds to the case when the variables are regarded as substitutes.[96]

Certainly, the choice of a particular relationship between the variables (dimensions or indicators) is not a simple task (Espinoza-Delgado & Silber, 2018); as noted by Thorbecke (2008, p. 17), the variables "can be substitutes in the short run while being complementary and re-enforcing in the long run", which has fundamental implications for the multidimensional poverty measurement over time. Considering this, in this paper, we suppose different degrees of substitutability ($\gamma = 1.25, 1.50, 1.75, 2.00$) and complementarity

[95] "A function f(x) has a non-decreasing marginal if $f(x_g + 1) - f(x_g) \geq f(x_h + 1) - f(x_h)$ whenever $x_g \geq x_h$" (Rippin, 2017, p. 61). The conditions that have to be satisfied by $[c_i]^{\gamma}$ are based on the "Theorem 1" proposed by Rippin (2013, p. 27). The proof of the Theorem can be found in Rippin (2017, p. 62-64).

[96] As observed by Espinoza-Delgado and Silber (2018, p. 9), based on Rippin (2013, 2017), if the variables are considered as complements, the increase in poverty severity is marginally decreasing in $c_i(x_i; z; w)$ as the loss in even one variable (dimension or indicator) can hardly be compensated. In other words, as soon as a person suffers from deprivation in one variable, he/she must suffer from some degree of poverty. If the variables are perfect complements, there is no compensation, and we obtain the union case; but if they are imperfect complements, we get the more general case approximated by a concave identification function. If, on the contrary, the variables are substitutes, there is compensation, and then the shortage in only one variable leads to a rather low degree of poverty severity as other variables can compensate for the deprivation. However, overall, the compensation capacity decreases as the number of deprivation increases; consequently, the poverty severity level is marginally increasing in $c_i(x_i; z; w)$. Therefore, if they are imperfect substitutes, we obtain the more general case of a convex function; but, if they are perfect substitutes, there is full compensation: As long as a person is not deprived in all variables his/her overall score will be equal to zero, which corresponds to the intersection case.

($\gamma = 0.25, 0.50, 0.75$) among the variables in order to verify the robustness of our main findings to these assumptions.

As observed by Silber and Yalonetzky (2014, p. 13), the literature on multidimensional poverty measurement with ordinal (dichotomized) variables requires the individual multidimensional poverty function not only to determine who is multi-dimensionally poor and who is not, but also to capture the multidimensional poverty breadth. In this vein, we make the individual multidimensional poverty function depends on "the number of deprivations", so we finally define this function as the product of the identification function and a function $g(x_i; z; w)$ that captures the poverty breadth. Let $p_i(x_i; z; w; k)$ be the individual multidimensional poverty function; then it can be expressed as

$$p_i(x_i; z; w; k) = \psi^{Fuzzy}(x_i; z; w; k)g(x_i; z; w) \quad (2)$$

In this paper, we use the multidimensional poverty breadth suggested by Alkire and Foster (2011a), which is defined as

$$g(x_i; z; w) = c_i(x_i; z; w) \quad (3)$$

Then, the individual multidimensional poverty function to be used in this paper is defined as

$$p_i(x_I; z; w; k) = [c_i(x_i; z; w)]^{\gamma} c_i(x_i; z; w) = [c_i(x_i; z; w)]^{\gamma+1} \quad (4)$$

5.2.2. The function that accounts for multidimensional poverty in the society

The second stage of the framework entails the construction of a social multidimensional poverty function $[P(X; z; w; k)]$ by aggregating the individual multidimensional poverty functions. Although in the literature there are various routes of carrying out this aggregation (Silber & Yalonetzky, 2014), we define the social multidimensional poverty function as the average of the individual multidimensional poverty functions; it is, therefore, defined as

$$P(X; z; w; k) = \frac{1}{n}\sum_{i=1}^{n}\sum_{j=1}^{d} p_i(x_i; z; w; k) = \frac{1}{n}\sum_{i=1}^{n}\sum_{j=1}^{d} \psi^{Fuzzy}(x_i; z; w; k)g(x_i; z; w) \quad (5)$$

Then, replacing (4) in (5), we obtain the "Multi-dimensional Correlation-Sensitive Class of Poverty Measures" $[P_{CS}^{\gamma}(X; z; w; k)]$ with ordinal (dichotomized) variables derived by Rippin (2017, p. 46):

$$P_{CS}^{\gamma}(X; z; w; k) = \frac{1}{n}\sum_{i=1}^{n}\sum_{j=1}^{d}[c_i(x_i; z; w)]^{\gamma}c_i(x_i; z; w) = \frac{1}{n}\sum_{i=1}^{n}[c_i(x_i; z; w)]^{\gamma+1} \qquad (6)$$

As demonstrated by Rippin (2013, 2017), this class of measures $[P_{CS}^{\gamma}(X; z; w; k)]$ satisfies a number of appealing axioms such as anonymity (AN), monotonicity (MN), principle of population (PP), strong focus (SF), normalization (NM), subgroup decomposability (SD), factor decomposability (FD), and sensitivity to inequality increasing switches (SIIS); it is also the only one in the literature on multidimensional poverty measurement that can be decomposed into the "three 'I's of poverty": incidence, intensity, and inequality (Jenkins & Lambert, 1997, p. 317).

Let q be the number of multi-dimensionally poor individuals; let $H = q/n$ be the multidimensional headcount ratio that measures the incidence of multidimensional poverty; let $A = \left[\sum_{i=1}^{q} c_i(x_i; z; w)\right]/q$ be the average deprivation score across the multi-dimensionally poor people that measures the poverty intensity (Alkire et al., 2015, p. 157), and let $GE_{\gamma+1}(c)$ be the generalized entropy inequality index among the multi-dimensionally poor individuals (Bérenger, 2017, p. 148), Eq. (6) can also be defined as

$$P_{CS}^{\gamma}(X; z; w; k) = HA^{\gamma+1}\{1 + [(\gamma+1)^2 - (\gamma+1)]\, GE_{\gamma+1}(c)\} \qquad (7)$$

In line with Rippin (2013, 2017), it is worth mentioning that the resulting multidimensional poverty incidence is, in fact, the headcount of the deprivation-affected in the society and coincides with the multi-dimensionally poor people as identified by the union approach (see Atkinson, 2003); this incidence may, therefore, be "too high to be useful" (Rippin, 2017, p. 43), particularly for targeting and prioritization of poverty alleviation policies and programs. To address this, in this paper, we propose to examine how the overall multidimensional poverty is distributed across the population, to rank individuals from the poorest to the richest, considering the individual multidimensional poverty functions, and to focus policies and programs addressed to poverty alleviation on the bottom 40 percent of the population; that is, to prioritize the poorest of the poor. Our suggestion is based on the targets 1.2 ("By 2030, reduce at least by half the proportion of men, women and children of all ages

living in poverty in all its dimensions according to national definitions") and 10.1 ("By 2030, progressively achieve and sustain income growth of the bottom 40 per cent of the population at a rate higher than the national average") of the SDGs (UN, 2015b, 2017).

It is also worthy of note that the M_0 measure is computed as the product of the incidence (H) and the intensity (A) of multidimensional poverty, so that the Eq. 7 can also be expressed as

$$P_{CS}^{\gamma}(X; z; w; k) = M_0 A^{\gamma}\{1 + [(\gamma + 1)^2 - (\gamma + 1)]\, GE_{\gamma+1}(c)\} \quad (8)$$

Accordingly, as noted by Espinoza-Delgado and Silber (2018, p. 12), the expression $A^{\gamma}\{1 + [(\gamma + 1)^2 - (\gamma + 1)]\, GE_{\gamma+1}(c)\}$ constitutes the substantive information that the M_0 measure totally overlooks when compared to the measure to be used in this paper; let us call the expression in curly brackets as inequality component (Bérenger, 2017; Rippin, 2013, 2017). Note that this information is especially important in the context of the SDGs, and its targets, and for gender inequality analysis (UN, 2015b, 2017); in fact, ignoring such information may lead to biased assessments of multidimensional poverty in the society and of anti-poverty programs and may also lead to leaving behind the poorest of the poor.

5.3. Data, dimensions, indicators and deprivation indicators

The data analyzed are drawn from the four most recent available rounds of the Nicaragua National Household Survey on Living Standards Measurement (EMNV in Spanish), conducted by the National Institute of Development Information (former National Institute of Statistics and Censuses) with support from the World Bank in 2001, 2005, 2009, and 2014. The survey is nationally representative and is the one used by the Government of Nicaragua to monitor progress in monetary poverty reduction and in the coverage of some basic needs such as water, sanitation, and housing (see INIDE, 2015, 2016). We use the person as the unit of analysis and include the household members who completed a full interview (22,589 people in 2001, 36,383 people in 2005, 30,258 people in 2009, and 29,381 people in 2014). Our multidimensional poverty measure comprises the same three dimensions as the global MPI (education, health, and standard of living) (Alkire & Jahan, 2018; Alkire & Santos, 2014), which are certainly among the most important aspect of people's well-being (Stiglitz, Sen, & Fitoussi, 2009a, 2009b); these can be considered as basic capabilities (Sen, 1993, 2000a) and can also be framed into the "Central Human Capabilities" suggested by

Nussbaum (2003, p. 41). The three dimensions are equally weighted, and the indicators used to measure each of them are described and defined in Espinoza-Delgado and Klasen (2018). Table 5.1 shows the dimensions, indicators, and the corresponding deprivation indicators.

Table 5.1: Dimensions, indicators, deprivation indicators.

Dimension (weight)	Indicator (weight)	Deprivation indicators
Education (1/3)	**Schooling achievement (1/3)**	He/she is not attending nursery school or pre-school or primary school and the head of the household has not completed the lower secondary school level (for children aged below 6 years)* He/she is not on track to complete the lower secondary school level by 17 years old (for children aged between 6 and 17 years)** He/she has not completed the lower secondary school level (for people aged 18 years or older)
Health (1/3)	**Health functioning failure (1/3)**	He/she suffered from a chronic disease or multiple diseases or an accident and/or an aggression in the month preceding the survey
Standard of Living (1/3)	**Housing (1/18)**	He/she is living in a house with dirt floor and/or precarious roof (waste, straw, palm and similar, other precarious material) and/or precarious wall materials (waste, cardboard, tin, cane, palm, straw, other precarious material)
	Water (1/18)	He/she does not have access to an improved drinking water source (public tap or standpipe, public or private well, piped water into dwelling, piped water to yard/plot) or has access to it, but out of the house and yard/plot
	Sanitation (1/18)	He/she only has access to an unimproved sanitation facility (a toilet or latrine without treatment or a toilet flushed without treatment to a river or a ravine) or to a shared toilet facility
	Electricity (1/18)	He/she does not have access to electricity
	Energy (1/18)	He/she is living in a household which uses wood and/or coal and/or dung as main cooking fuel
	Assets (1/18)	He/she has only access to less than two assets of the following list: radio, TV, bicycle, refrigerator, and motorized vehicle

* In Latin America, the empirical evidence has suggested that there is a positive correlation between the children's educational attainments and their parents' schooling years: the proportion of children that completes secondary school is over 60% when their parents have finished 10 or more years of schooling (Villatoro, 2007).
** In Nicaragua, the primary school entrance age is 6-7 years, so that children are expected to finish the lower secondary school level by 15-16 years old; hence, we provide a buffer of about two years to account for delayed progression, mainly in the rural areas. For example, a child aged 9 years will be considered to be deprived in education if he or she is currently attending first grade of primary school (Espinoza-Delgado & Klasen, 2018, p. 471).

In brief, the education dimension consists of schooling achievement, which considers the lower secondary school level as the normative target to define deprivation in this indicator (approx. nine years of schooling), in line with target 4.1 of the SDGs (UN, 2015b); the health dimension consists of health functioning failure, which exploits the scare information available on health in the datasets used and is mainly concerned with the prevalence of chronic diseases or multiple diseases among the Nicaraguan population; and the standard of

living dimension consists of housing (quality of building materials), water, sanitation, electricity, energy (main cooking fuel), and asset ownership, which are similar to the ones included in the global MPI (Alkire & Santos, 2014).

It is worthy of note that we assume that the living standard indicators are non-rivals and non-excludable; in other words, these are considered to be public goods accessible equally to every person within the household (Espinoza-Delgado & Klasen, 2018; Espinoza-Delgado & Silber, 2018; Vijaya et al., 2014). This is, of course, a strong assumption and clearly unsatisfactory, but in the absence of the information required to individualize these indicators, "it is not clear that one can do much better than that" (Klasen, 2007, p. 180). Therefore, we also take this paper to emphasize the necessity of collecting more and better individual data (Bradshaw et al., 2018; Espinoza-Delgado & Klasen, 2018; Pogge & Wisor, 2016; World Bank, 2017), mainly in the context of the 2030 sustainable development agenda.

5.4. Results

We first examine the overall progress in multidimensional poverty reduction in Nicaragua between 2001 and 2014, as well as by sub-periods: 2001-2005, 2005-2009, and 2009-2014. Table 2 shows the overall estimates of multidimensional poverty in this country, from 2001 to 2014, and the variations in relative terms, considering several degrees of inequality aversion.

The results in Table 5.2 suggest that overall multidimensional poverty in Nicaragua decreased by at least 17% between 2001 and 2014, a reduction mainly driven by the progress achieved in the first sub-period (2001-2005) and in the third sub-period (2009-2014) of our analysis; note that a relatively small decline (less than 2%) is observed between 2005 and 2009. In other words, multidimensional poverty in Nicaragua lessened by, approximately, 1.47% per year between 2001 and 2014, which means that this country will need, *ceteris paribus*, more than four decades to reduce multidimensional poverty by half. Focusing on the relative variations (Panel II of Table 5.2), the results reveals interesting findings that support the argument that an inequality-sensitive measure would be required to properly monitor progress in multidimensional poverty reduction, as inequality might be a non-neutral (and non-minor) issue over time, particularly in regions such as Latin American and the Caribbean (see, e.g., ECLAC, 2018a).

Table 5.2: Level and variation in multidimensional poverty in Nicaragua between 2001 and 2014, as well as between 2001-2005, 2005-2009, and 2009-2014.
Source: Author's estimates based on 2001-EMNV, 2005-EMNV, 2009-EMNV, and 2014-EMNV.

Panel I: Estimates of inequality-sensitive multidimensional poverty index

Year	Value of γ								
	0.00	0.25	0.50	0.75	1.00	1.25	1.50	1.75	2.00
2001	0.4322	0.3755	0.3297	0.2922	0.2610	0.2347	0.2126	0.1935	0.1771
	(0.0017)	(0.0016)	(0.0016)	(0.0015)	(0.0016)	(0.0015)	(0.0015)	(0.0014)	(0.0014)
2005	0.3996	0.3435	0.2988	0.2624	0.2323	0.2073	0.1861	0.1682	0.1529
	(0.0013)	(0.0013)	(0.0012)	(0.0011)	(0.0011)	(0.0011)	(0.0010)	(0.0009)	(0.0010)
2009	0.3923	0.3373	0.2936	0.2580	0.2288	0.2044	0.1839	0.1663	0.1514
	(0.0015)	(0.0015)	(0.0015)	(0.0015)	(0.0015)	(0.0014)	(0.0013)	(0.0014)	(0.0013)
2014	0.3561	0.3036	0.2624	0.2292	0.2022	0.1797	0.1610	0.1452	0.1317
	(0.0016)	(0.0016)	(0.0015)	(0.0015)	(0.0015)	(0.0015)	(0.0014)	(0.0015)	(0.0014)

Panel II: Variations in relative terms (%)

Period	Value of γ								
	0.00	0.25	0.50	0.75	1.00	1.25	1.50	1.75	2.00
2001-2005	-7.6***	-8.5***	-9.4***	-10.2***	-11.0***	-11.7***	-12.5***	-13.1***	-13.7***
2005-2009	-1.8***	-1.8***	-1.7***	-1.7***	-1.5***	-1.4***	-1.2***	-1.1***	-1.0***
2009-2014	-9.2***	-10.0***	-10.6***	-11.2***	-11.6***	-12.1***	-12.4***	-12.7***	-13.0***
2001-2014	-17.6***	-19.2***	-20.4***	-21.6***	-22.5***	-23.4***	-24.3***	-25.0***	-25.7***

Notes: Survey weights used; note that when γ takes a value of zero, the multidimensional poverty index becomes HA (the incidence times the intensity); that is, it is equal to the adjusted headcount measure (M_0 measure). The values in parentheses are the bootstrap estimates of the standard errors, which were computed following Efron's work (1981, pp. 139-143), with 1,000 stratified bootstrap replications.
Significance levels: *p < 0.1.; **p < 0.05; ***p < 0.01.

It can be seen in Table 5.2 that, between 2001 and 2014, the size of the variations, in relative terms, of multidimensional poverty becomes more substantial as the degree of inequality aversion increases, vis-à-vis the case in which inequality is completely disregarded (γ equal to zero); this reflects that inequality among the multi-dimensionally poor people has not remained unchanged over the period under scrutiny (when comparing two years, the ratio obtained is not equal to 1). Note that, only in the case of the second sub-period (2005-2009), the relative variations are quite similar, indicating that in this case, inequality has only slightly changed in the sub-period compared to what has happened in the other two sub-periods. Of course, we cannot reach a conclusion about the size and the direction of the inequality among the multi-dimensionally poor people by considering only the information displayed in the Panel II of Table 5.2, we must decompose the estimates into the three 'I's of multidimensional poverty (see Table 5.A.1 in Appendix 5.A), but the main reflection here is that inequality among the multi-dimensionally poor individuals does matter and should be incorporated into the multidimensional poverty analysis. We will discuss the inequality trend later on in this section; let us first investigate the distribution of multidimensional poverty across the population.

In line with the overarching concern of the 2030 sustainable development agenda, leaving no one behind (Klasen & Fleurbaey, 2018), we also try to find out how the overall multidimensional poverty estimates are distributed across the population. To do this, in each case, we construct a concave curve that looks like the three 'I's of poverty curves of Jenkins and Lambert (1997, p. 319); we obtain this curve by ranking individuals from poorest to richest, cumulating the average of multidimensional poverty by percentile, and plotting them on the base of these "100 observations" (see Espinoza-Delgado & Silber, 2018). The curve becomes horizontal at a point (percentile) that corresponds on the horizontal axis to the multidimensional headcount ratio (q/n); that is, the multidimensional poverty incidence is summarized by the length of the curve's non-horizontal section. The vertical height at which the curve becomes horizontal gives us the overall estimate of the multidimensional poverty index (Panel I of Table 5.2); in other words, the overall multidimensional poverty is summarized by the height of the curve: the vertical intercept at 100th percentile. Figure 5.1

displays the resulting curves for 2001, 2005, 2009, and 2014, considering three representative degrees of inequality aversion (0.50, 1.00, and 1.50).[97]

Figure 5.1 provides a more revealing picture of the overall multidimensional poverty in Nicaragua and of the progress made in the reduction of this issue over the period of analysis. Overall, it can be noted in the figure that whatever the percentile considered, multidimensional poverty in Nicaragua dropped between 2001 and 2014, but the observed progress was not evenly achieved: the reduction in relative terms of the multidimensional poverty for the bottom (poorest) 20 percent seems not to be substantial compared with the overall estimated decline, although this finding should be seen with some caution, because we are using cumulative distributions. When considering the three sub-periods separately, a similar performance can also be observed in the first sub-period (2001-2005) and in the third one (2009-2014); however, in the second sub-period (2005-2009), it can be seen that the 2009 curve intersects the 2005 curve once from above at around the 40th percentile, which means that the overall multidimensional poverty drop registered in this sub-period was only true from the 40th percentile onward: in Nicaragua, the poorest of the poor became even poorer between 2005 and 2009.

As far as inequality is concerned, by comparing the curvatures of the curves, Figure 1 suggests that it increased between 2001 and 2014, and did so in each of the three sub-periods, particularly in the first sub-period (2001-2005) and in the third one (2005-2009); in other words, people's deprivation scores (individual multidimensional poverty) were less unequally distributed in 2001 than in 2014, which should be a concern for policy-makers as progress in multidimensional poverty reduction in Nicaragua seems to be leaving behind the poorest of the poor. This finding can be corroborated by looking at the results in Table 5.A.1 in Appendix 5.A, which exhibits the decomposition of the overall multidimensional poverty estimates into the three dimensions of poverty (incidence, intensity, and inequality): the inequality among the multi-dimensionally poor individuals in Nicaragua increased by at least 24% between 2001 and 2014, despite the fact that in this country the incidence (-7.5%) and the intensity (-11%) of multidimensional poverty declined in this period.

[97] Similar curves are obtained when considering other degrees of inequality aversion, and the same conclusions can be drawn.

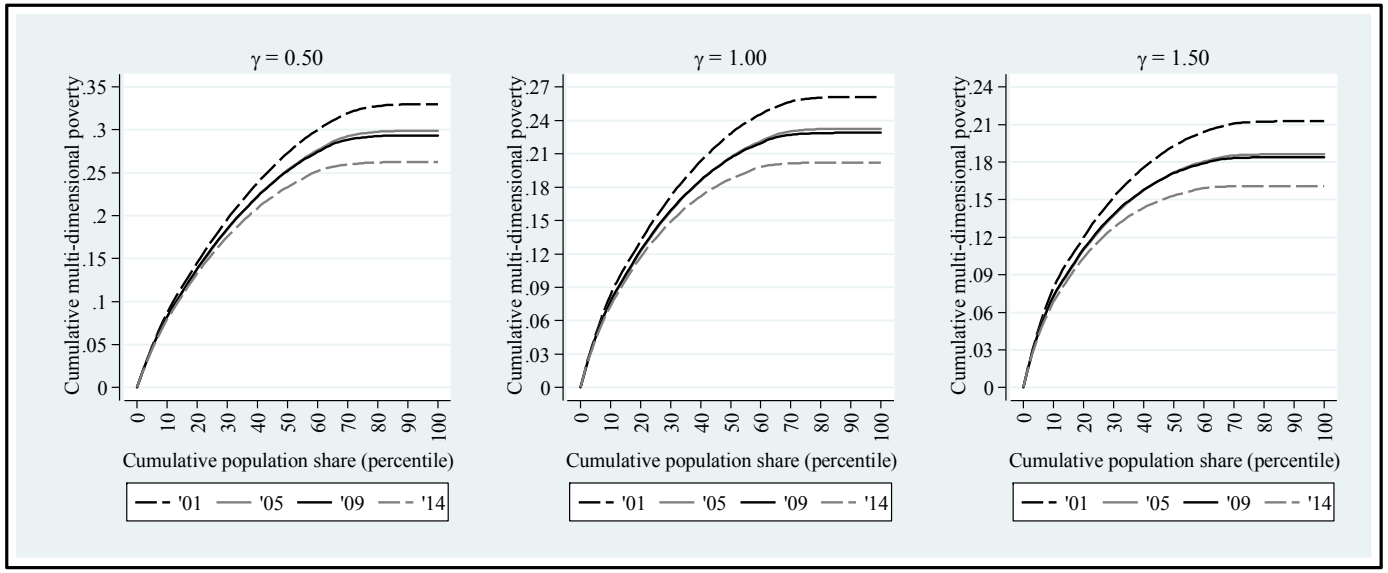

Figure 5.1: Cumulative multidimensional poverty by population percentile, ordered from the poorest to the richest.
Source: Authors' estimates based on 2001-EMNV, 2005-EMNV, 2009-EMNV, and 2014-EMNV.
Notes: In each case, the overall multidimensional poverty corresponds to the height of the curve; the incidence of multidimensional poverty (the headcount ratio) corresponds to the length of the non-horizontal section of the curve, that is, the percentile at which the curve becomes horizontal; while inequality among the multi-dimensionally poor individuals is approximated by the degree of concavity of the non-horizontal section of the curve (see Jenkins & Lambert, 1997).

As pointed out in Section 5.2, it can be seen in Table 5.A.1 that the estimated multidimensional poverty incidence in each year is too high (90.2% in 2001, 87.8% in 2005, 86.8% in 2009, and 83.4% in 2014) and thus might be not useful for the prioritization of poverty alleviation policies in Nicaragua; therefore, to this purpose, based on the targets 1.2 and 10.1 of the SDGs (UN, 2015b, 2017), we suggest that the country focuses on the bottom 40 percent of the population and conducts a dashboard approach to the design of social policies. In this vein, Table 5.A.2 in Appendix 5.A presents, for 2001 and 2014, the percentage of individuals deprived in each of the eight indicators considered in the analysis, as well as the variations in relative terms between 2001 and 2014, considering the bottom 40 percent of the population and the whole population. Overall, we find statistically significant progress in the reduction of deprivation in each of the eight indicators, but the size of the decrease is, in relative terms, quite dissimilar across the indicators: for example, considering the estimates for the bottom 40 percent, the results show that between 2001 and 2014, Nicaragua made an extraordinary progress in reducing deprivations in electricity (-55.2%) and in assets (-28.5%), but at the same time it only registered a marginal progress in education (-2.3%) and in housing (-3.4%).

The design of the proposed multidimensional poverty measure also allows us to assess the progress in poverty reduction among children, adults, and elderly. Table 5.3 exhibits the variations in relative terms of multidimensional poverty among children, adults, and elderly between 2001 and 2014, considering several degrees of inequality aversion.[98] The results indicate that in Nicaragua, the progress in multidimensional poverty in the period under analysis was not evenly achieved among the age groups: the highest drop (more than 27%) is observed among children, while the lowest one is registered among elderly (less than 12%). Therefore, we find that in Nicaragua, multidimensional poverty among children has decreased the fastest, which can be considered as good news and an encouraging finding. However, it is worth mentioning that inequality among the multi-dimensionally poor people in each of the three age groups has increased, which means that they have a pocket of multi-dimensionally poor that is being left behind.

[98] The point estimates and the corresponding bootstrap estimates of the standard errors are shown in Table 5.A.3 in Appendix 5.A.

Table 5.3: Progress in relative terms (%) in multidimensional poverty reduction among children, adults, and elderly between 2001 and 2014, considering several degrees of inequality aversion (values of gamma).
Source: Author's estimates based on 2001-EMNV and 2014-EMNV.

Value of gamma	Children	Adults	Elderly	The whole population
0.00	-27.39***	-17.87***	-7.69***	-17.60***
0.25	-30.32***	-19.58***	-8.54***	-19.15***
0.50	-32.81***	-21.06***	-9.13***	-20.40***
0.75	-34.95***	-22.34***	-9.81***	-21.56***
1.00	-36.90***	-23.47***	-10.35***	-22.52***
1.25	-38.65***	-24.64***	-10.77***	-23.41***
1.50	-40.20***	-25.66***	-11.20***	-24.26***
1.75	-41.54***	-26.48***	-11.69***	-24.97***
2.00	-42.71***	-27.32***	-11.95***	-25.66***

Notes: Survey weights used.
Significance levels: *p < 0.1.; **p < 0.05; ***p < 0.01.

5.4. Concluding remarks

Considering the overarching concern of the 2030 sustainable development agenda, leaving no one behind (Klasen & Fleurbaey, 2018), and the targets 1.2 and 10.1 of the SDGs, in this paper, we pointed out that the mainstream approach to the multidimensional poverty analysis in developing countries is deficient to properly monitor progress in multidimensional poverty reduction because it uses the household as the unit of analysis, ignoring thus intra-household inequalities, and is totally insensitive to inequality among the multi-dimensionally poor individuals, a serious defect of any poverty measure, according to Sen's (1976, 1979, 1992) discussion. Consequently, in the light of that concern, we proposed to depart somewhat from the mainstream approach and to adopt a person-focused and inequality-sensitive framework, which we have applied to the case of Nicaragua.

We found that in Nicaragua, multidimensional poverty decreased by at least 17% between 2001 and 2014, but this observed progress was not evenly achieved: the reduction in relative terms of the multidimensional poverty for the bottom (poorest) 20 percent seems not to be substantial compared to the overall estimated decline. As far as inequality among the multi-dimensionally poor is concerned, we also found that it increased by at least 24% in this period; that is, people's deprivation scores were less unequally distributed in 2001 than in 2014, which suggests that progress in multidimensional poverty reduction in Nicaragua seems to be leaving behind the poorest of the poor.

5.A. Appendix

Table 5.A.1: The three I's of multidimensional poverty in Nicaragua in 2001, 2005, 2009, and 2014, as well as the corresponding variations in relative terms.
Source: Author's estimates based on 2001-EMNV, 2005-EMNV, 2009-EMNV, and 2014-EMNV.

Panel I: Estimates of Incidence (H), Intensity (A), and Inequality [$GE_{\gamma+1}(c)$]										
Year	H (%)	A	$GE_{\gamma+1}(c)$, considering several values of γ							
			0.25	0.50	0.75	1.00	1.25	1.50	1.75	2.00
2001	90.2	0.4794	0.1405	0.1355	0.1320	0.1297	0.1285	0.1284	0.1291	0.1305
	(0.2144)	(0.0016)	(0.0017)	(0.0015)	(0.0016)	(0.0015)	(0.0015)	(0.0016)	(0.0016)	(0.0016)
2005	87.8	0.4548	0.1506	0.1452	0.1416	0.1393	0.1383	0.1385	0.1395	0.1416
	(0.1933)	(0.0013)	(0.0014)	(0.0014)	(0.0013)	(0.0013)	(0.0014)	(0.0013)	(0.0014)	(0.0014)
2009	86.8	0.4520	0.1563	0.1511	0.1474	0.1453	0.1444	0.1446	0.1459	0.1483
	(0.1769)	(0.0016)	(0.0016)	(0.0015)	(0.0015)	(0.0015)	(0.0016)	(0.0015)	(0.0017)	(0.0018)
2014	83.4	0.4269	0.1753	0.1701	0.1666	0.1648	0.1646	0.1655	0.1679	0.1715
	(0.1697)	(0.0017)	(0.0017)	(0.0016)	(0.0017)	(0.0018)	(0.0018)	(0.0019)	(0.0020)	(0.0021)
Panel II: Variations in relative terms (%)										
Period	H	A	$GE_{\gamma+1}(c)$, considering several values of γ							
			0.25	0.50	0.75	1.00	1.25	1.50	1.75	2.00
2001-2005	-2.6***	-5.1***	7.2***	7.1***	7.3***	7.4***	7.7***	7.9***	8.1***	8.5***
2005-2009	-1.2***	-0.6***	3.8***	4.0***	4.1***	4.3***	4.4***	4.5***	4.6***	4.7***
2009-2014	-3.9***	-5.6***	12.2***	12.6***	13.1***	13.4***	14.0***	14.5***	15.1***	15.7***
2001-2014	-7.5***	-11.0***	24.8***	25.5***	26.2***	27.1***	28.1***	29.0***	30.1***	31.4***

Notes: Survey weights used; H: The multidimensional headcount ratio; A: The average deprivation share among the multi-dimensionally poor individuals; $GE_{\gamma+1}(c)$: The generalized entropy inequality index among the multi-dimensionally poor individuals. The values in parentheses are the bootstrap estimates of the standard errors, which were computed following Efron's work (1981, pp. 139-143), with 1,000 stratified bootstrap replications. The multidimensional poverty levels shown in Table 2 can be calculated as follows: $(H/100)A^{\gamma+1}\{1+[(\gamma+1)^2-(\gamma+1)]GE_{\gamma+1}(c)\}$.
Significance levels: *p < 0.1.; **p < 0.05; ***p < 0.01.

Table 5.A.2: Percentage of individuals deprived in several indicators in 2001 and 2014, and variations in relative terms.
Source: Author's estimates based on 2001-EMNV and 2014-EMNV.

Indicator	The bottom 40 percent			The whole population		
	2001	2014	Variation in relative terms (%)	2001	2014	Variation in relative terms (%)
Education	95.5	93.3	-2.3***	60.7	48.7	-19.7***
	(0.2248)	(0.2754)		(0.3279)	(0.3260)	
Health	42.3	39.2	-7.3***	22.1	21.7	-1.4***
	(0.4318)	(0.5082)		(0.3012)	(0.2908)	
Housing	67.5	65.2	-3.4***	47.1	40.7	-13.6***
	(0.4192)	(0.5018)		(0.3155)	(0.2984)	
Water	68.8	56.9	-17.3***	41.3	35.0	-15.3***
	(0.3022)	(0.4038)		(0.1990)	(0.2504)	
Sanitation	72.0	66.3	-7.9***	54.6	44.5	-18.5***
	(0.4280)	(0.5145)		(0.3224)	(0.3265)	
Electricity	60.5	27.1	-55.2***	30.7	14.3	-53.6***
	(0.3339)	(0.4985)		(0.1964)	(0.2537)	
Energy	90.5	83.9	-7.3***	68.4	54.5	-20.3***
	(0.1933)	(0.1873)		(0.2346)	(0.1746)	
Assets	68.7	49.1	-28.5***	39.5	29.3	-25.9***
	(0.3858)	(0.5520)		(0.3073)	(0.3118)	

Notes: Survey weights used; the values in parentheses are the bootstrap estimates of the standard errors, which were computed following Efron's work (1981, pp. 139-143), with 1,000 stratified bootstrap replications. *Significance levels*: *p < 0.1.; **p < 0.05; ***p < 0.01.

Table 5.A.3: Level and variation in multidimensional poverty in Nicaragua between 2001 and 2014, by age group.
Source: Author's estimates based on 2001-EMNV and 2014-EMNV.

Panel I: Multi-dimensional poverty among children and variation in relative terms (%) between 2001 and 2014									
Year	Value of γ								
	0.00	0.25	0.50	0.75	1.00	1.25	1.50	1.75	2.00
2001	0.3797	0.3225	0.2776	0.2417	0.2127	0.1888	0.1687	0.1519	0.1375
	(0.0025)	(0.0023)	(0.0022)	(0.0021)	(0.0021)	(0.0020)	(0.0020)	(0.0019)	(0.0019)
2014	0.2757	0.2247	0.1865	0.1572	0.1342	0.1158	0.1009	0.0888	0.0788
	(0.0025)	(0.0027)	(0.0024)	(0.0024)	(0.0023)	(0.0022)	(0.0021)	(0.0020)	(0.0020)
2014-2001	-27.39***	-30.32***	-32.81***	-34.95***	-36.90***	-38.65***	-40.20***	-41.54***	-42.71***
Panel I: Multi-dimensional poverty among adults and variation in relative terms (%) between 2001 and 2014									
Year	Value of γ								
	0.00	0.25	0.50	0.75	1.00	1.25	1.50	1.75	2.00
2001	0.4563	0.3998	0.3534	0.3145	0.2819	0.2543	0.2308	0.2102	0.1925
	(0.0026)	(0.0026)	(0.0025)	(0.0024)	(0.0025)	(0.0024)	(0.0022)	(0.0023)	(0.0022)
2014	0.3748	0.3216	0.2790	0.2443	0.2157	0.1917	0.1715	0.1545	0.1399
	(0.0021)	(0.0022)	(0.0022)	(0.0022)	(0.0021)	(0.0021)	(0.0021)	(0.0021)	(0.0020)
2014-2001	-17.87***	-19.58***	-21.06***	-22.34***	-23.47***	-24.64***	-25.66***	-26.48***	-27.32***
Panel I: Multi-dimensional poverty among adults and variation in relative terms (%) between 2001 and 2014									
Year	Value of γ								
	0.00	0.25	0.50	0.75	1.00	1.25	1.50	1.75	2.00
2001	0.6508	0.5963	0.5486	0.5076	0.4711	0.4389	0.4105	0.3854	0.3627
	(0.0038)	(0.0042)	(0.0043)	(0.0045)	(0.0044)	(0.0046)	(0.0045)	(0.0047)	(0.0048)
2014	0.6007	0.5453	0.4985	0.4578	0.4223	0.3917	0.3645	0.3403	0.3193
	(0.0044)	(0.0046)	(0.0048)	(0.0053)	(0.0053)	(0.0056)	(0.0056)	(0.0057)	(0.0057)
2014-2001	-7.69***	-8.54***	-9.13***	-9.81***	-10.35***	-10.77***	-11.20***	-11.69***	-11.95***

Notes: Survey weights used; note that when γ takes a value of zero, the multidimensional poverty index becomes HA (the incidence times the intensity); that is, it is equal to the adjusted headcount measure (M_0 measure). The values in parentheses are the bootstrap estimates of the standard errors, which were computed following Efron's work (1981, pp. 139-143), with 1,000 stratified bootstrap replications.
Significance levels: *p < 0.1.; **p < 0.05; ***p < 0.01.

6. General conclusions, some limitations of the analyses and future research lines

6.1. Introduction

As noted by Kakwani and Silber (2008a, p. xi), the most significant development of poverty research in recent years is definitely "the shift of emphasis from a uni- to a multidimensional approach to poverty". In this line, this dissertation aimed at investigating cutting-edge issues in the measurement of poverty, taking a multidimensional approach and providing empirical evidence on Nicaragua and on other Central American countries, where the poorest people in Latin America and the Caribbean live.

Poverty measurement, as emphasized by Deaton (2015, p. 367), can be of great significance in and of itself because policy change is often grounded on it, and it is necessary if not sufficient for any reasoned assessment of policies advocated for poverty alleviation. In this regard, this dissertation challenged the mainstream approach to the measurement of multidimensional poverty in developing countries and proposed some empirical and methodological improvements accordingly, particularly considering the sustainable development agenda and its goals and targets (UN, 2015, 2017). Of course, the dissertation did not propose "an ideal multidimensional poverty index" for developing countries, its scope was much more modest, it was only able to provide "trends and not laws", in line with Hutchinson's thoughts (1977, p. 277), offer an enhanced poverty measurement package to each of the countries under analysis, and, in general, contribute to the discussion of poverty measurement.

This dissertation, overall, contributed to the literature on poverty measurement in Nicaragua and Central American countries by providing updated empirical evidence on individual-based multidimensional poverty in those countries and on inequality among the multi-dimensionally poor individuals, one of the three "dimensions of poverty" that has been ignored by the vast majority of empirical works concerned with multidimensional poverty analysis (Jenkins & Lambert, 1997, p. 317), even beyond the Central American region, as well as by shedding some light on gender differences in the three I's of multidimensional poverty, which also represents a novelty in the literature focused on those countries. It also made significant contributions to the global literature on these issues by using the individual

rather than the household as the unit of analysis to the measurement of multidimensional poverty and gender differences, as well as by proposing a person-focused and inequality-sensitive approach to monitoring progress in multidimensional poverty reduction in developing countries, mainly considering Goals 1 and 5 of the SDGs and the central overarching concern of the SDGs agenda: Leaving no one behind (Klasen & Fleurbaey, 2018).

6.2. Main general conclusions

The main general conclusions that can be drawn from this dissertation can be summarized as follows.

- In Nicaragua, the monetary approach used to derive the official poverty measure is incapable of capturing the multiple deprivations suffered by the Nicaraguan population, which is in line with what the literature on the subject has suggested, and, therefore, the design, evaluation, and monitoring of poverty reduction policies in this country should not be exclusively based on the official (monetary) approach, but should be supported with a broader measure that incorporates other important dimensions of the well-being of the Nicaraguans. In other words, the findings of this dissertation emphasize the necessity of shifting the emphasis from a monetary approach to a multidimensional poverty approach.
- Household-based multidimensional poverty indices overlook intra-household inequalities because these equate the poverty condition of the household with the poverty condition of all individuals belonging to the household; accordingly, these measures are, by definition, incapable of revealing gender differences within the household as they are gender blind and may provide biased estimates of the extent of multidimensional poverty in aggregate: for example, if females are systematically poorer than males, or if children and elderly are systematically worse-off than other household members, overall poverty may be understated when one employs a measure that treats everybody in the household equally, which may in turn affect targeting and effectiveness of poverty alleviation policies. In this vein, this dissertation makes a case for a more disaggregated multidimensional poverty analysis

since its empirical results show that multidimensional poverty can be very different for different age groups in the society, even within the same household, challenging thus household-based multidimensional poverty measures, such as the global-MPI or the MPI-LA.

- This dissertation also suggests to go beyond the overall multidimensional poverty estimates and to investigate how these estimates are distributed across the population. In this line, it proposes a concave curve that looks like the three I's of poverty curves of Jenkins and Lambert (1997, p. 319), which is obtained by ranking individuals from poorest to richest, cumulating the average of multidimensional poverty by percentile (100), and plotting them on the base of these "100 observations". This curve provides a more revealing picture of the overall multidimensional poverty and of the progress reached in the reduction of this social problem. For example, for the case of Nicaragua, the analysis reveals that multidimensional poverty in Nicaragua dropped between 2001 and 2014, but the observed progress was not evenly achieved: the reduction in relative terms of the multidimensional poverty for the bottom 20 percent seems not to be substantial compared with the overall estimated decline.
- The results point out that inequality among the multi-dimensionally poor individuals may be a serious issue; it should, consequently, be taken into account when deriving a multidimensional poverty index. Considering the findings of this dissertation, it may happen that the gender gap in multidimensional poverty incidence in a country is relatively small, but, at the same time, the gender difference in inequality may be substantially larger whether females (or males) have a "pocket" of multi-dimensionally poor people who suffer from very intense poverty and their male (female) counterparts do not: the larger the size of the "pocket", the greater the gender gap in inequality. In Nicaragua, for example, multidimensional poverty does not seem to be "feminized", but inequality among the multi-dimensionally poor individuals does, especially among adults, which suggests that Nicaraguan women live in very intense poverty compared to men. This kind of finding is not captured by inequality insensitive multidimensional poverty measures, such as the official multidimensional poverty indices of several

Governments in Latin American and the Caribbean, which are based on the Alkire and Foster's method (2011).

- Although, in general, especially among policy-makers and international agency discourse, there is a belief that female-headed households are more likely to be poorer than male-headed households, the empirical evidence found here does not seem to support this assertion, not at least for the case of Nicaragua, particularly when a multidimensional approach to the measurement of poverty is adopted. This dissertation thus supports earlier studies that challenge the notion that female-headed households are worse-off than those led by males in terms of poverty.
- The findings of this dissertation indicate that evaluations of women's relative multidimensional poverty may depend on what is measured and what dimensions of gendered poverty are considered in the assessments, in line with Bradshaw, Chant, and Linneker (2017a, 2018). For example, it has been found that in Guatemala, El Salvador, Honduras, Nicaragua, and Costa Rica the size and the direction of the gender gaps in multidimensional poverty and inequality depend on the deprivation definition (threshold) used for the employment dimension, that is, on the information incorporated into the analysis (unpaid care and domestic work).
- Given that any index based on Alkire and Foster's methodology (2011), which can be regarded as the "mainstream approach" in developing countries, pays no attention to the distribution of deprivations when only ordinal (dichotomized) variables are available-the most common case in practice-and is thus totally insensitive to inequality among the multi-dimensionally poor, and also considering that the "mainstream practice" of multidimensional poverty measurement uses the household as the unit of analysis, which can also be problematic as discussed above, this dissertation advocates the benefits of departing somewhat from the mainstream approach, as well as the mainstream practice, and for adopting an individual-based and inequality sensitive view of multidimensional poverty; in this vein, it offers overwhelming evidence that support this advocacy. For example, it has been found that in Nicaragua, inequality among the multi-dimensionally poor individuals increased by at least 24% between 2001 and 2014, despite the fact

that in this country the incidence (-7.5%) and the intensity (-11%) of multidimensional poverty declined in this period, which suggests that progress in multidimensional poverty reduction in Nicaragua seems to be leaving behind the poorest of the poor. Consequently, we consider that the proposed change in this dissertation is indispensable to track progress in reaching Goals 1 and 5 of the SDGs as well as to meet the overarching concern of the SDGs agenda: Leaving no one behind.

6.3. Some limitations of the analyses

Although the analyses conducted in this dissertation provide interesting findings and insights, they are not exempt from limitations. Therefore, in this section, we highlight some of them.

Firstly, it must be recognized that due to data restrictions and the unfitness of the surveys used to capture gendered experiences of poverty, we have only partly succeeded in individualizing the multidimensional poverty measures and in assessing gender differences in poverty and inequality.

On one hand, the assumption that the living standard indicators are public goods is clearly unsatisfactory and might lead to underestimations of women's poverty and inequality, as the gender literature has suggested that the deprivation in some of them (particularly in water, energy, and assets) impacts women substantially more than men (Bradshaw et al., 2017a; Duflo, 2008a, 2008b, 2010; 2012; Sorenson, et al., 2011). On the other hand, although the dimensions considered in the analysis are key well-being dimensions, both for males and for females, and can also be framed into the list proposed by Robeyns (2003) for gender inequality assessment, many of the dimensions of gendered poverty that are known to exist in the literature on gender inequality, such as violence against women and girls, time poverty, and power poverty, which have mainly been explored in qualitative studies and using small-scale surveys, are missing in the analysis (see, e.g. Agarwal, 1994, 1997; Bessell, 2015; Bradshaw, 2002, 2013; Bradshaw et al., 2017a, 2017b, 2018; Brickell & Chant, 2010; Chant, 2008, 2016; Duflo, 2012; Deere et al., 2012; Pogge & Wisor, 2016; Robeyns, 2003).

However, it is also fair to say that in the absence of the relevant information and more refined data (e.g., a time use module, individual data on assets ownership, or subjective

information from individuals), it is impossible to identify which individual (woman) in the household is most affected (Vijaya, et al., 2014). Therefore, we also endorse the idea that more and better individual data are needed, particularly in the context of the SDGs (Bradshaw et al., 2017a, 2017b, 2018; Pogge & Wisor, 2016; World Bank, 2017).

Secondly, although the application of the inequality sensitive framework proposed in this dissertation provides "additional informative content" about multidimensional poverty in the society, the class of multidimensional poverty measures used requires specifying explicitly the kind of relationship existing between the variables considered in the analysis. Yet, the choice of a particular relationship between the variables (dimensions or indicators) is certainly not a simple task; as noted by Thorbecke (2008, p. 17), the variables "can be substitutes in the short run while being complementary and re-enforcing in the long run", which has fundamental implications for the multidimensional poverty measurement over time, as discussed in this dissertation. In addition to this, for policy-makers, the framework might be less simple than the methodology proposed by Alkire and Foster (2011), the "mainstream approach", and, consequently, less "popular".

Thirdly, as noted by Sen (1999, p. 1), the challenge of sustainable development should not only include a) the elimination of persistent and endemic deprivation, i.e., poverty, but also b) the removal of vulnerability to sudden and severe destitution. This latter issue, therefore, should also be a concern of high priority from a policy perspective, as success in poverty alleviation may not guarantee success in reducing vulnerability (Chakravarty, 2018). In this regard, identifying who the vulnerable are, specifying how vulnerability is characterized, what its determinants are, and finding appropriate measures become crucial elements for the design of policies aimed at the removal of such an issue (Klasen & Waibel, 2013).

Although closely related, poverty and vulnerability are different phenomena, which demands separate analysis and distinct approaches (Chakravarty, 2018; Klasen & Waibel, 2013). Poverty research is, on one hand, concerned with determining actual poverty levels ex post ("as effective outcome") (Gallardo, 2018, p. 1077), and it seeks to explain trends and determinants in poverty (Klasen & Waibel, 2013). Vulnerability tries, on the other hand, to assess the ex-ante poverty risk of households and people (Hohberg, Landau, Kneib, Klasen, & Zucchini, 2018): "before the veil of uncertainty has been lifted" (Calvo & Dercon, 2005, p. 2).

That is to say, in contrast to the research on poverty, which is regarded as a backward-looking study, due to its ex post perspective, the work on vulnerability is considered a forward-looking analysis (see, e.g., Chaudhuri, Jalan, & Suryahadi, 2002; Calvo & Dercon, 2007, 2013; Dercon, 2006; Pritchett, Suryahadi, & Aumarti, 2000; Suryahadi & Sumarto, 2003). This is crucial, as observed by Klasen and Waibel (2013, p. 3), both from a research as well as a policy perspective. From the research perspective, the vulnerability approach thereby combines risks and shocks into poverty assessment and joins together both strands to make ex-ante evaluations of future poverty risks and explores their drivers. From the policy point of view, it is clear that successful poverty alleviation policies and programs should target those individuals at risk of future poverty rather than just try to support those that were identified as poor in the past.

Vulnerability is, therefore, an important issue in the poverty analysis for both intrinsic and instrumental reasons. It is a subject of interest on its own and also has significant implications for economic efficiency and long-run individual welfare (Chakravarty, Chattopadhyay, Silber, & Wan, 2016; Fujii, 2016): "Many individuals face adversity in terms of continued illness, natural calamities, and other risks. These people can fall into poverty in the wake of adverse shocks" (Chakravarty, 2018, p. 251); in other words, not only current conditions matter for actual welfare, but also the risk individuals face, "as well as their (in) ability to prevent, mitigate and cope with these" (Klasen & Povel, 2013, p. 17-18). This dissertation has only, however, been concerned with the static aspect of poverty and has thus ignored the dynamic component and vulnerability research, i.e., the assessments of ex-ante poverty risk, which is not only an important poverty dimension but can also be a cause of long-term deprivation: combating vulnerability has the potential to lessen long-run poverty.

6.4. Future research lines

Considering some of the limitations discussed above, we have already started to work a research project aiming at examining cutting-edge issues in the measurement and analysis of vulnerability and welfare dynamics. Moving from a unidimensional (monetary) approach to a multidimensional one, this project plans to provide empirical evidence on the forward-looking agenda on measuring vulnerability to poverty and on welfare dynamics in developing countries, to explore the determinants of vulnerability, and to derive policy implications to lessen such vulnerability.

7. Conclusiones generales, algunas limitaciones del análisis y futuras líneas de investigación

7.1. Introducción

El logro más notable de la literatura preocupada por la medición de la pobreza en los últimos años es definitivamente el cambio de énfasis del análisis: pasar de un enfoque unidimensional a uno multidimensional (Kakwani y Silber, 2008a, p. xi). En esta línea, esta tesis se planteó investigar temas de vanguardia en la medición de la pobreza, adoptar un enfoque multidimensional y proporcionar evidencia empírica sobre Nicaragua y sobre otros países centroamericanos, donde viven las personas más pobres de América Latina y el Caribe.

La medición de la pobreza, como enfatiza Deaton (2015, p. 367), es de gran importancia en sí misma porque el cambio de políticas a menudo se basa en ella, y es necesaria, si no suficiente, para cualquier evaluación razonada de las políticas dirigidas al alivio de la pobreza. En este sentido, esta tesis cuestionó el enfoque general para la medición de la pobreza multidimensional en los países en desarrollo y propuso algunas mejoras empíricas y metodológicas en consecuencia, particularmente considerando la agenda de desarrollo sostenible y sus metas y objetivos (UN, 2015, 2017). Por supuesto, la tesis no propuso el "índice ideal de pobreza multidimensional" para los países en desarrollo, su alcance fue mucho más modesto, solo pudo proporcionar "tendencias y no leyes", en línea con los pensamientos de Hutchinson (1977, p. 277), ofrecer a cada uno los países analizados un herramienta mejorada para la medición de la pobreza y, en general, contribuir a la discusión sobre estas cuestiones.

La tesis, en general, contribuyó a la literatura sobre la medición de la pobreza en Nicaragua y en los países de América Central al proporcionar evidencia empírica actualizada sobre la pobreza multidimensional basada en el individuo en esos países y sobre la desigualdad entre los individuos pobres en múltiples dimensiones, una de las tres "dimensiones de la pobreza" que ha sido ignorada por la gran mayoría de los trabajos empíricos relacionados con el análisis multidimensional de la pobreza (Jenkins y Lambert, 1997, p. 317), incluso más allá de la región centroamericana; así mismo, la tesis ofreció

evidencia empírica sobre las diferencias de género en pobreza multidimensional y desigualdad, lo cual también representa una novedad en la literatura centrada en esos países. También, la tesis hizo importantes contribuciones a la literatura global al utilizar a la "persona" como unidad de análisis e identificación, y no el "hogar", a diferencia de la gran mayoría de trabajos empíricos sobre estos temas, para medir la pobreza y estimar el diferencial de género, y al proponer un enfoque centrado en la persona y sensible a la desigualdad para monitorear el progreso en la reducción de la pobreza multidimensional en los países en desarrollo, considerando particularmente los objetivos 1 y 5 de los ODS y la preocupación central de la agenda de los ODS: "no dejar a nadie atrás" (Klasen y Fleurbaey, 2018).

7.2. Principales conclusiones

Las principales conclusiones que pueden extraerse de esta tesis pueden resumirse de la siguiente manera.

- En Nicaragua, el enfoque monetario utilizado para derivar la medida oficial de pobreza es incapaz de capturar las múltiples privaciones sufridas por la población nicaragüense; por lo tanto, el diseño, evaluación y monitoreo de las políticas de reducción de la pobreza en este país no deben basarse exclusivamente en el enfoque oficial (monetario), sino que deben apoyarse en una medida más amplia que incorpore otras dimensiones importantes del bienestar de los nicaragüenses. En otras palabras, los resultados de esta tesis enfatizan la necesidad de complementar el enfoque monetario con un enfoque multidimensional.
- Los índices de pobreza multidimensional basados en el hogar pasan por alto las desigualdades dentro del hogar porque equiparan la condición de pobreza del hogar con la condición de pobreza de todos los individuos que pertenecen al mismo; en consecuencia, estas medidas son, por definición, incapaces de revelar las diferencias de género dentro del hogar, ya que son ciegas al género, y podrían proporcionar estimaciones sesgadas de la pobreza multidimensional global: por ejemplo, si las mujeres son sistemáticamente más pobres que los hombres, o si los niños y las personas mayores están sistemáticamente en una peor situación que otros miembros del hogar, la pobreza general podría ser

subestimada si se emplea una medida que trata igual, en términos de pobreza, a todos los miembros en el hogar, lo que a su vez puede afectar la focalización y la eficacia de las políticas de alivio de la pobreza. En este sentido, esta tesis aboga por un análisis de pobreza multidimensional más desagregado, ya que sus resultados empíricos muestran que la pobreza multidimensional puede ser muy diferente para diferentes grupos de edad en la sociedad, incluso dentro del mismo hogar, desafiando así las medidas de pobreza multidimensional basadas en el hogar.

- Esta tesis también sugiere ir más allá de las estimaciones globales de pobreza multidimensional e investigar cómo se distribuyen dichas estimaciones entre la población. En esta línea, propone una curva cóncava, similar a la propuesta por Jenkins y Lambert (1997, p. 319), pero en un contexto multidimensional. Esta curva proporciona una imagen más reveladora de la pobreza multidimensional general y del progreso alcanzado en la reducción de este problema social. Por ejemplo, para el caso de Nicaragua, el análisis revela que la pobreza multidimensional en Nicaragua se redujo entre 2001 y 2014, pero el progreso observado no se logró de manera uniforme: la reducción en términos relativos de la pobreza multidimensional para el 20 por ciento inferior no parece ser sustancial en comparación con la disminución global estimada.
- Los resultados señalan que la desigualdad entre los individuos pobres en múltiples dimensiones podría ser un problema de gran calado, y, en consecuencia, debe tenerse en cuenta cuando se derive un índice de pobreza multidimensional. Considerando los hallazgos de esta tesis, podría darse el caso de que la brecha de género en la incidencia de la pobreza multidimensional en un país determinado sea relativamente pequeña, pero, al mismo tiempo, la diferencia de género en la desigualdad sea sustancialmente mayor si entre las mujeres (o los hombres) existe un grupo de personas que sufre de pobreza multidimensional muy intensa, pero que no existe entre su contraparte masculina. En Nicaragua, por ejemplo, la pobreza multidimensional no parece estar "feminizada", pero la desigualdad entre los individuos pobres en múltiples dimensiones, especialmente entre los adultos, sugiere que las mujeres nicaragüenses viven en una pobreza muy intensa en comparación con los hombres. Este tipo de hallazgo no puede ser reflejado por

las medidas de pobreza multidimensional que son insensibles a la desigualdad, como, por ejemplo, los índices oficiales de pobreza multidimensional de varios países en América Latina y el Caribe, que siguen la metodología propuesta por Alkire y Foster (2011).

- Aunque, en general, existe la creencia de que los hogares encabezados por mujeres tienen más probabilidades de ser más pobres que los hogares encabezados por los hombres, la evidencia empírica encontrada no parece apoyar esta afirmación, no al menos en el caso de Nicaragua, particularmente cuando se adopta un enfoque multidimensional para medir la pobreza. Esta tesis, por lo tanto, soporta estudios previos que desafían la idea de que los hogares encabezados por mujeres son, normalmente, más pobres que los liderados por hombres.
- Los resultados de esta tesis indican que las evaluaciones de la pobreza multidimensional relativa de las mujeres pueden depender de "qué se mide" y de "qué dimensiones" de la pobreza se consideran en el análisis, en línea con Bradshaw, Chant y Linneker (2017a, 2018).
- Dado que cualquier índice basado en la metodología de Alkire y Foster (2011), la cual puede considerarse como el "enfoque principal" en los países en desarrollo, no presta atención a la distribución de las privaciones, cuando solo están disponibles variables ordinales, el caso más común en la práctica, y, por lo tanto, es totalmente insensible a la desigualdad entre los multidimensionalmente pobres, y considerando también que la "práctica general" para la medición de la pobreza multidimensional utiliza el hogar como unidad de análisis, esta tesis aboga por apartarse un tanto del enfoque general, así como de la práctica general, y por adoptar una visión individual de la pobreza multidimensional y sensible a la desigualdad.

7.3. Algunas limitaciones del análisis

Si bien el análisis llevado a cabo en esta tesis ofrece hallazgos interesantes, no está exento de limitaciones. Por ello, en esta sección, destacamos algunas de estas limitaciones.

En primer lugar, debe reconocerse que, debido a la falta de datos individuales, solo hemos podido individualizar parcialmente las medidas de pobreza multidimensional y evaluar en parte las diferencias de género en pobreza y desigualdad.

Por un lado, el supuesto adoptado de que los indicadores bajo la dimensión "nivel de vida" son bienes públicos es claramente insatisfactorio, y podría conducir a subestimaciones de la pobreza y de la desigualdad entre las mujeres, ya que la literatura sobre desigualdad de género ha sugerido que la privación en algunos de estos indicadores (especialmente en "agua", "energía" y "activos") afecta sustancialmente más a las mujeres que a los hombres (Bradshaw et al., 2017a; Duflo, 2008a, 2008b, 2010; 2012; Sorenson, et al., 2011). Por otro lado, aunque las dimensiones consideradas en el análisis son dimensiones claves del bienestar, tanto para hombres como para mujeres, y que también se pueden enmarcar en la lista propuesta por Robeyns (2003) para la evaluación de la desigualdad de género, muchas de las dimensiones de la pobreza que afectan particularmente a las mujeres, como por ejemplo la violencia contra las mujeres y las niñas, la pobreza del tiempo y la pobreza de poder, que han sido exploradas principalmente en estudios cualitativos y mediante encuestas de pequeña escala, no han sido incluidas en nuestro análisis (ver, por ejemplo, Agarwal, 1994, 1997; Bessell, 2015; Bradshaw, 2002, 2013; Bradshaw et al., 2017a, 2017b, 2018; Brickell & Chant, 2010; Chant, 2008, 2016; Duflo, 2012; Deere et al. , 2012; Pogge & Wisor, 2016; Robeyns, 2003).

Sin embargo, es justo decir que ante la ausencia de la información relevante y de datos más refinados (por ejemplo, un módulo de uso del tiempo, datos individuales sobre la propiedad de activos o información subjetiva de los individuos) es imposible identificar qué individuo (hombre o mujer) en el hogar es el más afectado por las privaciones observadas (Vijaya, et al., 2014). Por lo tanto, nosotros también respaldamos la idea de que se necesitan más y mejores datos individuales, particularmente en el contexto de los ODS (Bradshaw et al., 2017a, 2017b, 2018; Pogge & Wisor, 2016; Banco Mundial, 2017).

En segundo lugar, aunque la aplicación del marco sensible a la desigualdad propuesto en esta tesis proporciona un "contenido informativo adicional" sobre la pobreza multidimensional en la sociedad, la clase de medidas utilizadas requiere de la elección explícita del tipo de relación existente entre las variables consideradas en el análisis. Sin embargo, la selección de una relación particular entre las variables (dimensiones o indicadores) no es una tarea sencilla; tal como lo señala Thorbecke (2008, p. 17), las

variables podrían ser sustitutas en el corto plazo y complementarias en el largo plazo, lo que tiene implicaciones para la medición de la pobreza multidimensional en el tiempo, como se analiza en esta tesis. Adicionalmente, el marco de análisis sugerido en esta tesis podría resultar menos simple para los responsables de la formulación de políticas que la metodología propuesta por Alkire y Foster (2011) y, por consiguiente, menos "popular".

En tercer lugar, como lo señala Sen (1999, p. 1), el desafío del desarrollo sostenible no solo debería incluir a) la eliminación de privaciones persistentes, es decir, la pobreza, sino también b) la eliminación de la vulnerabilidad a la pobreza. Esta última cuestión, por lo tanto, también debe ser una preocupación de alta prioridad desde una perspectiva política, ya que el éxito en el alivio de la pobreza puede no garantizar el éxito en la reducción de la vulnerabilidad (Chakravarty, 2018). En este sentido, identificar quiénes son los vulnerables, especificar cómo se caracteriza la vulnerabilidad, cuáles son sus determinantes y encontrar medidas adecuadas son elementos cruciales para el diseño de políticas destinadas a eliminar dicho problema (Klasen y Waibel, 2013).

La vulnerabilidad es un tema importante en el análisis de la pobreza por razones tanto intrínsecas como instrumentales. Es un tema de interés por sí mismo y también tiene importantes implicaciones para la eficiencia económica y el bienestar individual a largo plazo (Chakravarty, Chattopadhyay, Silber, & Wan, 2016; Fujii, 2016). Sin embargo, esta tesis solo se ha preocupado por el aspecto estático de la pobreza y, por lo tanto, ha ignorado el componente dinámico y la investigación de la vulnerabilidad, es decir, las evaluaciones del riesgo de pobreza *ex ante*, lo cual no solo representa una "dimensión" importante de la pobreza sino que también podría ser una causa de privación en el largo plazo: combatir la vulnerabilidad tiene el potencial de disminuir la pobreza en el largo plazo.

7.4. Futuras líneas de investigación

Teniendo en cuenta algunas de las limitaciones discutidas anteriormente, ya hemos comenzado a trabajar en un proyecto de investigación que apunta a examinar temas de vanguardia en la medición y análisis de la vulnerabilidad y las dinámicas de bienestar. Pasando de un enfoque unidimensional (monetario) a uno multidimensional, este proyecto planea proporcionar evidencia empírica sobre la medición de la vulnerabilidad a la pobreza y sobre las dinámicas de bienestar en los países en desarrollo, explorar los determinantes de la vulnerabilidad y derivar políticas para disminuir dicha vulnerabilidad.

References

Agarwal, B. (1994). Gender and command over property: A critical gap in economic analysis and policy in South Asia. *World Development*, *22*(10), 1455-1478. https://doi.org/10.1016/0305-750X(94)90031-0.

Agarwal, B. (1997). "Bargaining" and gender relations: Within and beyond the household. *Feminist Economics*, *3*(1), 1-51. https://doi.org/10.1080/135457097338799.

Agbodji, A. E., Batana, Y. M., & Ouedraogo, D. (2015). Gender inequality in multidimensional welfare deprivation in West Africa: The case of Burkina Faso and Togo. *International Journal of Social Economics*, *42*(11), 980-1004. https://doi.org/10.1108/IJSE-11-2013-0270.

Alkire, S., & Foster, J. (2007). Counting and multidimensional poverty measurement, *OPHI Working Paper*, No. 7, Oxford, Oxford Poverty and Human Development Initiative, University of Oxford.

Alkire, S., & Foster, J. (2011a). Counting and multidimensional poverty measurement. *Journal of Public Economics*, *95*(7-8), 476-487. https://doi.org/10.1016/j.jpubeco.2010.11.006.

Alkire, S., & Foster, J. (2011b). Understandings and misunderstandings of multidimensional poverty measurement. *The Journal of Economic Inequality*, 9(2), 289-314. https://doi.org/10.1007/s10888-011-9181-4.

Alkire, S., Foster, J., Seth, S., Santos, M. E., Roche, J. M., & Ballón, P. (2015). *Multidimensional poverty measurement and analysis*. Oxford: Oxford University Press.

Alkire, S., & Jahan, S. (2018). The new global MPI 2018: Aligning with the sustainable development goals. HDRO Occasional Paper, Human Development Report Office (HDRO), United Nations Development Program (UNDP). Retrieved from http://hdr.undp.org/sites/default/files/2018_mpi_jahan_alkire.pdf.

Alkire, S., Meinzen-Dick, R., Peterman, A., Quisumbing, A., Seymour, G., & Vaz, A. (2013). The women's empowerment in agriculture index. *World Development*, *52*, 71-91. https://doi.org/10.1016/j.worlddev.2013.06.007.

Alkire, S., Roche, J.M., & Vaz, A. (2017). Changes over time in multidimensional poverty: Methodology and results for 34 countries. *World Development*, *94*, 232-249. https://doi.org/10.1016/j.worlddev.2017.01.011.

Alkire, S., & Santos, M.E. (2010). Acute multidimensional poverty: A new index for developing countries. *OPHI Working Papers*, 38, Oxford Poverty & Human Development Initiative (OPHI), University of Oxford. https://dx.doi.org/10.2139/ssrn.1815243.

Alkire, S., & Santos, M.E. (2014). Measuring acute poverty in the developing world: Robustness and scope of the multidimensional poverty index. *World Development*, *59*, 251-274. https://doi.org/10.1016/j.worlddev.2014.01.026.

Alkire, S., & Seth, S. (2008). Measuring multidimensional poverty in India: A new proposal. *OPHI Working Paper*, No. 15, Oxford, Oxford Poverty and Human Development Initiative, University of Oxford. Retrieved from http://citeseerx.ist.psu.edu/viewdoc/download;jsessionid=6E7865DCFCD2A2BB8F70AD275A992E4B?doi=10.1.1.423.6072&rep=rep1&type=pdf.

Alkire, S., & Seth, S. (2014a). Measuring and decomposing inequality among the multi-dimensionally poor using ordinal data: A counting approach. *OPHI Working Papers 68*. Oxford: University of Oxford. Retrieved from http://opendocs.ids.ac.uk/opendocs/handle/123456789/11812.

Alkire, S., & Seth, S. (2014b). Inequality among the MPI poor, and regional disparity in multidimensional poverty: Levels and trends. *OPHI Briefing 25*. Oxford: University of Oxford. Retrieved from: http://www.ophi.org.uk/wp-content/uploads/Inequality-Among-the-MPI-Poor-and-Regional-Disparity-in-Multidimensional-Poverty-Levels-and-Trends.pdf?0a8fd7.

Anand, S., & Sen, A. (1997). Concepts of human development and poverty: A multidimensional perspective. *Human Development Papers 1997*. United Nation Development Program (UNDP), New York. Retrieved from http://clasarchive.berkeley.edu/Academics/courses/center/fall2007/sehnbruch/UNDP%20Anand%20and%20Sen%20Concepts%20of%20HD%201997.pdf.

Altamirano, Á. J., & Teixeira, K. M. D. (2017). Multidimensional poverty in Nicaragua: Are female-headed households better off? *Social Indicators Research*. *132*(3), 1037-1063. https://doi.org/10.1007/s11205-016-1345-y.

Asfaw, A., Klasen, S., & Lamanna, F. (2010). Gender gap in parents' financing strategy for hospitalization of their children: Evidence from India. *Health Economics*, *19*(3), 265-279. https://doi.org/10.1002/hec.1468.

Atkinson, A. B. (2003). Multidimensional deprivation: Contrasting social welfare and counting approach. *Journal of Economic Inequality*, *1*(1), 51-65. Retrieved from https://link.springer.com/content/pdf/10.1023%2FA%3A1023903525276.pdf.

Atkinson, A. B., Cantillon, B., Marlier, E., & Nolan, B. (2002). *Social indicators*. *The EU and social inclusion*. Oxford: Oxford University Press.

Arber, S., & Cooper, H. (1999). Gender differences in health in later life: The new paradox? *Social Science & Medicine*, *48*(1), 61-76. https://doi.org/10.1016/S0277-9536(98)00289-5.

Barnett, W. S. (1995). Long-term effects of early childhood programs on cognitive and school outcomes. *The Future of Children*, *5*(3), 25-50. Retrieved from http://www.jstor.org/stable/1602366.

Barnett, W. S. (2002). Early childhood education. In A. Molnar (Ed.), *School reform proposals: The research evidence* (pp. 1-26). Greenwich, Connecticut: Information Age Publishing.

Barnett, W. S., & Ackerman, D. J. (2006). Costs, benefits, and long-term effects of early care and education programs: Recommendations and cautions for community developers. *Journal of the Community Development Society*, *37*(2), 86-100. https://doi.org/10.1080/15575330609490209.

Bartik, T. J. (2014). *From preschool to prosperity: The economic payoff to early childhood education*. Kalamazoo, MI: W. E. Upjohn Institute for Employment Research. https://doi.org/10.17848/9780880994835.

Bastos, A., Casaca, S. F., Nunes, F., & Pereirinha, J. (2009). Women and poverty: A gender-sensitive approach. *The Journal of Socio-Economics*, *38*(5), 764-778. https://doi.org/10.1016/j.socec.2009.03.008.

Batana, Y. M. (2013). Multidimensional measurement of poverty among women in Sub-Saharian Africa. *Social Indicators Research*, *112*(2), 337-362. https://doi.org/10.1007/s11205-013-0251-9.

Battiston, D., Cruces, G., López-Calva, L. F., Lugo, M. A., & Santos, M. E. (2013). Income and beyond: Multidimensional poverty in six Latin American countries. *Social Indicators Research*, *112*(2), 291-314. https://doi.org/10.1007/s11205-013-0249-3.

Belzil, C., & Hansen, J. (2003). Structural estimates of the intergenerational education correlation. *Journal of Applied Econometrics*, *18*(6), 679-696. https://doi.org/10.1002/jae.716.

Bérenger, V. (2016). Measuring multidimensional poverty in the three Southeast Asian countries using ordinal variables. In J. Silber & G. Wan (Eds.), *The Asian 'poverty miracle'. Impressive accomplishments or incomplete achievements?* (pp. 149-214). Retrieved from https://www.adb.org/sites/default/files/publication/218046/adbi-asian-poverty-miracle.pdf.

Bérenger, V. (2017). Using ordinal variables to measure multidimensional poverty in Egypt and Jordan. *Journal of Economic Inequality*, *15*(2), 143-173. https://doi.org/10.1007/s10888-017-9349-7.

Bessell, S. (2015). The individual deprivation measure: Measuring poverty as if gender and inequality matter. *Gender & Development*, *23*(2), 223-240. http://dx.doi.org/10.1080/13552074.2015.1053213.

Betti, G., Cheli, B., Lemmi, A., & Verma, V. (2008). The fuzzy set approach to multidimensional poverty: The case of Italy in the 1990s. In N. Kakwani & J. Silber (Eds.), *Quantitative approaches to multidimensional poverty measurement* (pp. 30-48). London: Palgrave-Macmillan.

Boltvinik, J. (2013). Medición multidimensional de pobreza. América Latina de precursora a rezagada". *Revista Sociedad & Equidad*, No. 5.

Boone, C., Glick, P., & Sahn, D. E. (2011). Household water supply choice and time allocated to water collection: Evidence from Madagascar". *The Journal of Development Studies*, *47*(12), 1826-1850. https://doi.org/10.1080/00220388.2011.579394.

Bourguignon, F., & Chakravarty, S. R. (2003). The measurement of multidimensional poverty. *Journal of Economic Inequality*, *1*(1), 25-49. Retrieved from https://link.springer.com/content/pdf/10.1023%2FA%3A1023913831342.pdf.

Bradshaw, S. (2002). *Gendered poverties and power relations: Looking inside communities and households*. Managua, Nicaragua: Puntos de Encuentro. Retrieved from http://eprints.mdx.ac.uk/4031/.

Bradshaw, S. (2013). Women's decision making in rural and urban households in Nicaragua: The influence of income and ideology. *Environment and Urbanization*, *25*(1), 81-94. https://doi.org/10.1177/0956247813477361.

Bradshaw, S., Chant, S., & Linneker, B. (2018). Challenges and changes in gendered poverty: The feminization, de-feminization, and re-feminization of poverty in Latin America. *Feminist Economics*, 1-26. https://doi.org/10.1080/13545701.2018.1529417.

Bradshaw S., Chant, S., & Linneker, B. (2017a). Knowing gendered poverty in the global south: A protracted path to progress? *Spazio Filosofico*, *20*(2), 265-286. Retrieved from http://eprints.lse.ac.uk/id/eprint/85657.

Bradshaw, S., Chant, S., & Linneker, B. (2017b). Gender and poverty: What we know, don't know, and need to know for Agenda 2030. *Gender, Place & Culture*, *24*(12), 1667-1688. https://doi.org/10.1080/0966369X.2017.1395821.

Brandolini, A. & Aaberge, R. (2014) Multi-dimensional inequality and poverty. In A. Atkinson and F. Bourguignon (Eds) *Handbook of Income Distribution* Vol. 2A (pp. 141-216).

Brown, C., Ravallion, M., & van de Walle, D. (2018). Most of Africa's nutritionally-deprived women and children are not found in poor households. *Review of Economics and Statistics*. https://doi.org/10.1162/rest_a_00800.

Brickell, K., & Chant, S. (2010). 'The unbearable heaviness of being': Reflections on female altruism in Cambodia, Philippines, The Gambia and Costa Rica. *Progress in Development Studies*, *10*(2), 145-159. https://doi.org/10.1177/146499340901000204.

Buvinić, M., & Gupta, G. R. (1997). Female-headed households and female-maintained families: Are they worth targeting to reduce poverty in developing countries? *Economic Development and Cultural Change*, *45*(2), 259-280. Retrieved from http://www.journals.uchicago.edu/doi/pdfplus/10.1086/452273.

Cage, R. A., & Foster, J. (2002). Overcrowding and infant mortality: A tale of two cities. *Scottish Journal of Political Economy*, *49*(2), 129-149. http://dx.doi.org/10.1111/1467-9485.00225.

Cahill, M., & Sánchez, N. (2001). Using principal components to produce an economic and social development index: An application to Latin America and the U.S. *Atlantic Economic Journal*, 29(3), 311-329. https://doi.org/10.1007/BF02300552.

Calvo, C. & Dercon, S. (2005). Measuring individual vulnerability. *Discussion Paper Series*, Number 229, Department of Economics, University of Oxford. Retrieved from https://ora.ox.ac.uk/objects/uuid:aec11fc8-51d7-414e-b0ce-9bd274e9417f/download_file?file_format=pdf&safe_filename=JOURNAL&type_of_work=Working+paper.

Calvo, C., & Dercon, S. (2007). Vulnerability to poverty. *Working Paper Series*, CSAE WPS/2007-03. Retrieved from https://ora.ox.ac.uk/objects/uuid:9922cd6f-3d11-44ee-832c-d48141a33cce/download_file?file_format=pdf&safe_filename=2007-03text.pdf&type_of_work=Working+paper.

Calvo, C., & Dercon, S. (2013). Vulnerability to individual and aggregate poverty. *Social Choice and Welfare*, *41*(4), 721–740. https://doi.org/10.1007/s00355-012-0706-y.

Cameron, S. V., & Heckman, J. J. (2001). The dynamics of educational attainment for black, hispanic, and white males. *Journal of Political Economy*, *109*(3), 455-499. Retrieved from http://www.journals.uchicago.edu/doi/pdfplus/10.1086/321014.

Campbell, F., Conti, G., Heckman, J. J., Moon, S. H., Pinto, R., Pungello, E., & Pan, Y. (2014). Early Childhood Investments Substantially Boost Adult Health. *Science*, *343*(6178), pgs. 1478-1485. http://dx.doi.org/10.1126/science.1248429.

Case, A., & Deaton, A. (2003). Consumption, health, gender, and poverty. *Policy Research Working Paper*, *3020*. World Bank, Washington DC. Retrieved from https://openknowledge.worldbank.org/handle/10986/18261.

Case, A., & Deaton, A. (2005a). Broken down by work and sex: How our health declines. In D. Wise (Ed.), *Analysis in the economics of aging* (pp. 185-212). Chicago: University of Chicago Press. Retrieved from http://www.nber.org/essays/c10361.pdf.

Case, A., & Deaton, A. (2005b). Health and wealth among the poor: India and South Africa compared. *American Economic Review*, *95*(2), 229-223. Retrieved from https://pubs.aeaweb.org/doi/pdf/10.1257/000282805774670310.

Case, A., & Paxson, Ch. (2005). Sex differences in morbidity and mortality. *Demography*, *42*(2), 189-241. Retrieved from https://link.springer.com/content/pdf/10.1353%2Fdem.2005.0011.pdf.

Castillo, R., & Jácome, F. (2015). *Medición de la pobreza multidimensional en Ecuador*. Instituto Nacional de Estadística y Censos. Retrieved from http://www.ecuadorencifras.gob.ec/documentos/web-inec/Sitios/Pobreza_Multidimensional/assets/ipm-metodologia-oficial.pdf.

Cerioli, A., & Zani, S. (1990). A fuzzy approach to the measurement of poverty. In C. Dagum, & M. Zenga (Eds.), *Income and wealth distribution, inequality and poverty. Studies in contemporary economics* (pp. 272-284). https://doi.org/10.1007/978-3-642-84250-4_18.

Chakravarty, S. R. (2006). An axiomatic approach to multidimensional poverty measurement via fuzzy sets. In A. Lemmi & G. Betti (Eds.), *Fuzzy set approach to multidimensional poverty measurement* (pp. 49-72). New York, N.Y.: Springer.

Chakravarty, S. R. (2018). *Analyzing multidimensional well-being: a quantitative approach* (first edition). https://doi.org/10.1002/9781119257424.

Chakravarty, S. R., Chattopadhyay, N., Silber, J, & Wan, G. (2016). Measuring the impact of Vulnerability on the number of poor: A new methodology with empirical illustrations. In J. Silber & G. Wan (Eds.), *The Asian poverty miracle: Impressive accomplishments or incomplete achievements?* (pp. 84–117). Northampton: Edward Elgar.

Chakravarty, S. R., Deutsch, J., & Silber, J. (2008). On the watts multidimensional poverty index and its decomposition. *World Development*, *36*(6), 1067-1077. https://doi.org/10.1016/j.worlddev.2007.10.003.

Chakravarty, S. R., & Lugo, M. A. (2016). Multidimensional indicators of inequality and poverty. In M. Adler & M. Fleurbaey (Eds.), *The Oxford handbook of well-being and public policy* (pp. 246-285). Oxford: Oxford University Press.

Chakravarty S. R., & Silber, J. (2008). Measuring multidimensional poverty: The axiomatic approach. In N. Kakwani & J. Silber (Eds.), *Quantitative approaches to multidimensional poverty measurement* (pp. 192-209). New York, N. Y.: Palgrave Macmillan.

Chant, S. (1997). Women-headed households: Poorest of the poor? Perspectives from Mexico, Costa Rica and the Philippines. *IDS Bulletin*, *28*(3), 26-48. http://dx.doi.org/10.1111/j.1759-5436.1997.mp28003003.x.

Chant, S. (2004). Dangerous equations? How female-headed households became the poorest of the poor: Causes, consequences and cautions. *IDS Bulletin*, *35*(4), 19-26. http://dx.doi.org/10.1111/j.1759-5436.2004.tb00151.x.

Chant, S. (2008). The 'feminisation of poverty' and the 'feminisation' of anti-poverty programmes: Room for revision? *Journal of Development Studies*, *44*(2), 165-197. https://dx.doi.org/10.1080/00220380701789810.

Chant, S. (2016). Women, girls, and world poverty: Empowerment, equality or essentialism? *International Development Planning Review*, *38*(1), 1-24. https://doi.org/10.3828/idpr.2016.1.

Chaudhuri, S., Jalan, J., & Suryahadi, A. (2002). Assessing household vulnerability to poverty from cross-sectional data: a methodology and estimates from Indonesia. *Discussion Paper Series*, Number 0102-52, Department of Economics, Columbia University. Retrieved from https://pdfs.semanticscholar.org/0b46/82f418dd8dbae0d5ce45221d6d9f76ad21ef.pdf.

Cheli, B., & Lemmi, A (1995). Totally fuzzy and relative approach to the multidimensional analysis of poverty. *Economic Notes*, *21*, 115-134.

Chiappero Martinetti, E. (2000). A multidimensional assessment of well-being based on Sen's functioning approach. *Rivista Internazionale di Scienze Sociali*, *108*(2), 207-239. https://www.jstor.org/stable/41634742.

Chiappero Martinetti, E. (2006). Capability approach and fuzzy set theory: Description, aggregation and inference issues. In A. Lemmi & G. Betti (Eds.), *Fuzzy set approach to multidimensional poverty measurement* (pp. 93-113). New York, N.Y.: Springer.

Chiappori, P. A. (2016). Welfare and the household. In M. Adler & M. Fleurbaey (Eds.), *The Oxford handbook of well-being and public policy* (pp. 821-843). Oxford: Oxford University Press.

Chiappori, P. A., & Meghir, C. (2015). Intrahousehold inequality. In A. B. Atkinson & F. Bourguignon (Eds.), *Handbook of income distribution, volume 2* (pp. 1369-1418). https://doi.org/10.1016/B978-0-444-59429-7.00017-0.

CIASES (2016). *Prioridades de la Educación Nicaragüense para el Siglo XXI*. Managua, Nicaragua: Centro de Investigación y Acción Educativa Social (CIASES). Retrieved from http://ciases.org.ni/wp-content/uploads/2016/10/prioridadesEducacion.pdf.

Clancy, J., Ummar, F, Shakya, I., & Kelkar, G. (2007). Appropriate Gender-Analysis Tools for Unpacking the Gender-Energy-Poverty Nexus. *Gender and Development*, *15*(2), 241-257. https://doi.org/10.1080/13552070701391102.

CONEVAL (2011). Metodología para la medición multidimensional de la pobreza en México. *Realidad, Datos y Espacio. Revista Internacional de Estadística y Geografía*, *2*(1), 36-63. Retrieved from http://www.inegi.org.mx/rde/rde_02/doctos/rde_02_opt.pdf.

Cunha, F., Heckman, J. J., & Schennach, S. M. (2010). Estimating technology of cognitive and noncognitive skill formation. *Econometrica*, *78*(3), 883-931. https://doi.org/10.3982/ECTA6551.

Dammert, A. C. (2010). Siblings, child labor, and schooling in Nicaragua and Guatemala. *Journal of Population Economics*, *23*(1), 199-224. https://doi.org/10.1007/s00148-008-0237-0.

DANE-DIMPE (2014). *Metodología. Índice de pobreza multidimensional (IPM)*. Departamento Adminsitrativo Nacional de Estadística (DANE), Dirección Técnica de Metodología y Producción Estadística (DIMPE), República de Colombia. Retrieved from https://www.scribd.com/document/357409184/Metodologia-IPM-2.

Datt, G. (2018). Distribution-sensitive multidimensional poverty measures. *The World Bank Economic Review*, 2017, pp. 1-22. https://doi.org/10.1093/wber/lhx017.

Deaton, A. (1997). *The analysis of household surveys. A microeconometric approach to development policy*. Published for the World Bank, The Johns Hopkins University Press: Baltimore, Maryland, USA. Retrieved from http://documents.worldbank.org/curated/en/593871468777303124/pdf/multi-page.pdf.

Deaton, A. (2016). Measuring and understanding behavior, welfare, and poverty. *American Economic Review*, *106*(6), pp. 1221-1243. http://dx.doi.org/10.1257/aer.106.6.1221.

Decancq, K., & Lugo, M. A. (2013). Weights in multidimensional indices of wellbeing: An overview. *Econometric Reviews*, *32*(1), 7-34. https://doi.org/10.1080/07474938.2012.690641.

Decreto No. 975. (1982). *Reglamento general de la ley de seguridad social*. Retrieved from http://legislacion.asamblea.gob.ni/normaweb.nsf/9e314815a08d4a6206257265005d21f9/6140e1c582c4095c062570a10057e6bb?OpenDocument.

Deere, C. D., Alvarado, G. E., & Twyman, J. (2012). Gender inequality in asset Ownership in Latin America: Female owners vs household heads. *Development and Change*, *43*(2), 505-530. http://dx.doi.org/10.1111/j.1467-7660.2012.01764.x.

Del Carpio, X., & Castro, V. (2007). *Voices of Nicaragua: A qualitative and quantitative approach to viewing poverty in Nicaragua*. Background Paper for World Bank Country Assessment, Managua, Nicaragua.

Dercon, S. (2006). Vulnerability: A micro perspective. In F. Bourguignon, Pleskovic, B., & J. van der Gaag (Eds.), *Securing development in an unstable world* (pp. 117-146). Washington, D. C.: The World Bank.

Deutsch, J., & Silber, J. (2005). Measuring multidimensional poverty: An empirical comparison of various approaches. *Review of Income and Wealth*, 51(1), 145-174. http://dx.doi.org/10.1111/j.1475-4991.2005.00148.x.

Dotter, C., & Klasen, S. (2017). The multidimensional poverty index: Achievements, conceptual, and empirical issues. *Discussion Papers*, *233*. Courant Research Centre: Poverty, Equity and Growth in Developing and Transition Countries: Statistical Methods and Empirical Analysis. Georg-August-Universität Göttingen. Retrieved from https://www.econstor.eu/bitstream/10419/162856/1/893991872.pdf.

Doyle, O., Harmon, C. P., Heckman, J. J., & Tremblay, R. E. (2009). Investing in early human development: Timing and economic efficiency. *Economics and Human Biology*, *7*(1), 1-6. https://doi.org/10.1016/j.ehb.2009.01.002.

Drèze, J., & Sen, A. (2002). *India: Development and participation* (2nd ed.). Oxford: Oxford University Press.

Drèze, J., & Srinivasan, P. V. (1997). Widowhood and poverty in rural India: Some inferences from household survey data. *Journal of Development Economics*, *54*(2), 217-234. https://doi.org/10.1016/S0304-3878(97)00041-2.

Duclos, J-Y., Sahn, D. E., & Younger, S. D. (2006). Robust multidimensional poverty comparisons. *The Economic Journal*, *116*(514), 943-968. https://doi.org/10.1111/j.1468-0297.2006.01118.x.

Duclos, J-Y., Sahn, D., & Younger, S. (2008). Using an ordinal approach to multidimensional poverty analysis. In N. Kakwani & J. Silber (Eds.), *Quantitative approaches to multidimensional poverty measurement* (pp. 244-261). New York: Palgrave MacMillan.

Duclos, J-Y., & Tiberti, L. (2016). Multidimensional poverty indices: A critical assessment. In M. Adler & M. Fleurbaey (Eds.), *The Oxford handbook of well-being and public policy* (pp. 677-708). Oxford: Oxford University Press.

Duflo, E. (2012). Women empowerment and economic development. *Journal of Economic Literature*, *50*(4), 1051-1079. http://dx.doi.org/10.1257/jel.50.4.1051.

Duflo, E., Greenstone, M., & Hanna, R. (2008a). Indoor air pollution, health and economic well-being. *S.A.P.I.EN.S*, *1*(1), 7-16. Retrieved from http://journals.openedition.org/sapiens/130.

Duflo, E., Greenstone, M., & Hanna, R. (2008b). Indoor air pollution and respiratory health in rural Orissa. *Economic and Political Weekly*, *43*(32), 71-76. Retrieved from http://scholar.harvard.edu/files/remahanna/files/epw_cooking_stoves.pdf.

Duflo, E., Greenstone, M., & Hanna, R. (2016). Up in smoke: The influence of household behavior on the long-run impact of improved cooking stoves. *American Economic Journal*, *8*(1), 80-114. http://dx.doi.org/10.1257/pol.20140008.

Duryea, S., & Robles, M. (2017). *Social pulse in Latin America and the Caribbean 2017: Family legacy, breaking the mold or repeating patterns?* Inter-America Development Bank. http://dx.doi.org/10.18235/0000924.

ECLAC (2003). *Pobreza y vulnerabilidad social: Mercado de trabajo e inversión social en el Istmo Centroamericano a inicios del Milenio*. The Economic Commission for Latin America and the Caribbean (ECLAC). Santiago [online] http://www.eclac.org/publicaciones/xml/9/13909/L586-1.pdf.

ECLAC (2009). *Income poverty and unsatisfied basic needs* (LC/MEX/L.949). The Economic Commission for Latin America and the Caribbean (ECLAC). Mexico City, ECLAC Subregional Headquarters in Mexico [online] http://www.eclac.cl/publicaciones/xml/0/38190/L949.pdf.

ECLAC (2013). *Social panorama of Latin America, 2013* (LC/G.2580-P). The Economic Commission for Latin America and the Caribbean (ECLAC). United Nations, Santiago de Chile, 2013. Retrieved from http://repositorio.cepal.org/bitstream/handle/11362/36736/1/S2013869_en.pdf.

ECLAC (2015). *Latin America and the Caribbean in the world economy, 2015* (LC/G.2650-P). Economic Commission for Latin America and the Caribbean (ECLAC), United Nation, Santiago de Chile, Chile, 2015. Retrieved from https://repositorio.cepal.org/bitstream/handle/11362/39011/4/S1501141_en.pdf.

ECLAC (2016). *Horizons 2030: Equality at the centre of sustainable development* (LC/G.2660/Rev.1). The Economic Commission for Latin America and the Caribbean (ECLAC). United Nations, Santiago de Chile, 2016. Retrieved from http://200.9.3.98/bitstream/handle/11362/40160/S1600652_en.pdf?sequence=4&isAllowed=y.

ECLAC (2017). *Social Panorama of Latin America, 2016 (LC/PUB.2017/12-P)*. Economic Commission for Latin America and the Caribbean (ECLAC), United Nation, Santiago de Chile, Chile, 2017. Retrieved from https://repositorio.cepal.org/bitstream/handle/11362/41599/4/S1700566_en.pdf.

ECLAC (2018a). *The inefficiency of inequality (LC/SES.37/3-P)*. Economic Commission for Latin America and the Caribbean (ECLAC), Santiago de Chile, Chile. Retrieved from https://repositorio.cepal.org/bitstream/handle/11362/43443/6/S1800058_en.pdf.

ECLAC (2018b). *Social Panorama of Latin America, 2017 (LC/PUB.2018/1-P)*. Economic Commission for Latin America and the Caribbean (ECLAC), United Nation, Santiago de Chile, Chile, 2018. Retrieved from https://repositorio.cepal.org/bitstream/handle/11362/42717/1/S1800001_en.pdf.

Eckstein, Z., & Wolpin, K. I. (1999). Why youths drop out of high school: The impact of preferences, opportunities, and abilities. *Econometrica*, *67*(6), 1295-1339. http://dx.doi.org/10.1111/1468-0262.00081.

Efron, B. (1981). Nonparametric standard errors and confidence intervals. *The Canadian Journal of Statistics*, *9*(2), 139-158. http://dx.doi.org/10.2307/3314608.

Elender, F., Bentham, G., & Langford, I. (1998). Tuberculosis mortality in England and Wales during 1982-992: Its association with poverty, ethnicity and AIDS. *Social Science & Medicine*, *46*(6), 673-681. https://doi.org/10.1016/S0277-9536(97)00178-0.

Espinoza-Delgado, J., & Klasen, S. (2018). Gender and multidimensional poverty in Nicaragua: An individual based approach. *World Development*, *118*, 466-491. https://doi.org/10.1016/j.worlddev.2018.06.016.

Espinoza-Delgado, J., & López-Laborda, J. (2015). Evolución de la pobreza multidimensional en Nicaragua, 2001-2009. *Documento de Trabajo*, No. 762, Funcas [online] http://www.funcas.es/publicaciones/Sumario.aspx?IdRef=7-05762.

Espinoza-Delgado, J. & López-Laborda, J. (2017). Nicaragua: Trend of multidimensional poverty, 2001-2009. *CEPAL Review*, *121*, 31-51. http://dx.doi.org/10.18356/965f43f9-en.

Espinoza-Delgado, J., & Silber, J. (2018). Multi-dimensional poverty among adults in Central America and gender differences in the three I's of poverty: Applying inequality sensitive poverty measures with ordinal variables. *Discussion Papers*, No. 237, Ibero-America Institute for Economic Research, University of Goettingen. Retrieved from https://www.econstor.eu/bitstream/10419/182396/1/1031651985.pdf.

Ferrant, G., Pesando, L. M., & Nowacka, K. (2014). Unpaid care work: The missing link in the analysis of gender gaps in labor outcomes. *OECD Development Center*, December 2014. Retrieved from http://www.oecd.org/dev/development-gender/unpaid_care_work.pdf.

Ferreira, F. H. G. (2011). Poverty is multidimensional. But what are we going to do about it? *The Journal of Economic Inequality*, *9*, 493-495. https://doi.org/10.1007/s10888-011-9202-3.

Ferreira, F. H. G., & Lugo, M. A. (2013). Multidimensional poverty analysis: Looking for a middle ground. *World Bank Research Observer*, *28*(2), 220-235. https://doi.org/10.1093/wbro/lks013.

Fine, L. J., Philogene, G. S., Gramling, R., Coups, E. J., & Sinha, S. (2004). Prevalence of multiple chronic disease risk factors. 2001 National Health Interview Survey. *American Journal of Prevent Medicine*, *27*(2), 18-24. http://dx.doi.org/10.1016/j.amepre.2004.04.017.

Foster, J., Greer, J., & Thorbecke, E. (1984). A class of decomposable poverty measures. *Econometrica*, *52*(3), 761-766. Retrieved from http://www.jstor.org/stable/1913475.

Foster, J., Greer, J., & Thorbecke, E. (2010). The Foster-Greer-Thorbecke (FGT) poverty measures: 25 years later. *Journal of Economic Inequality*, *8*(4), 491-524. http://dx.doi.org/10.1007/s10888-010-9136-1.

Franco, A. (2017). *On the measurement of multidimensional poverty as a policy tool. Empirical applications to Chile, Colombia, Ecuador and Peru*. Doctoral Dissertation, Maastricht University, Netherland. Retrieved from www.merit.unu.edu/training/theses/franco_andrea.pdf.

Fujii, T. (2016). Concepts and measurement of vulnerability to poverty and other issues: A review of literature. In J. Silber & G. Wan (Eds.), *The Asian poverty miracle: Impressive accomplishments or incomplete achievements?* (pp. 53–83). Northampton: Edward Elgar.

Fukuda-Parr, S. (1999). What does feminization of poverty mean? It isn't just lack of income. *Feminist Economics*, *5*(2), 99-103. https://doi.org/10.1080/135457099337996.

Gallardo, M. (2018). Identifying vulnerability to poverty: A critical survey. *Journal of Economic Surveys*, *32*(4), 1074-1105. https://doi.org/10.1111/joes.12216.

Gall, E. T., Carter, E. M., Earnest, C. M., & Stephens, B. (2013). Indoor air pollution in developing countries: Research and implementation needs for improvements in global public health. *American Journal of Public Health*, *103*(4), e67-e72. https://dx.doi.org/10.2105%2FAJPH.2012.300955.

Gamboa, L., & Krüger, N. (2016). ¿Existen diferencias en América Latina en el aporte de la educación preescolar al logro educativo futuro? *Revista CEPAL*, *118*, 85-100. Retrieved from http://repositorio.cepal.org/bitstream/handle/11362/40031/RVE118_Gamboa.pdf?sequence=1&isAllowed=y.

Gasparini, L., Alejo, J., Haimovich, F., Olivieri, S., & Tornarolli, L. (2010). Poverty among older people in Latin America and the Caribbean. *Journal of International Development*, *22*(2), 176-207. https://doi.org/10.1002/jid.1539.

Gertler, P., Heckman, J., Pinto, R., Zanolini, A., Vermeersch, C., Walker, S., Chang, S. M., & Grantham-McGregor, S. (2013). Labor market returns to early childhood stimulation: A 20-year followup to an experimental intervention in Jamaica. *NBER Working Paper Series*, *19185*, National Bureau of Economic Research, Cambridge, MA. Retrieved from http://www.nber.org/papers/w19185.

GRUN (2011). *Política nacional de primera infancia. Amor para los más chiquitos y chiquitas*. Gobierno de Reconciliación y Unidad Nacional de Nicaragua (GRUN). Managua, Nicaragua.

Hayes, N. (2008). *The role of early childhood care and education – An anti-poverty prespective*. Combat Poverty Agency, Dublin. Retrieved from http://www.combatpoverty.ie/publications/TheRoleOfEarlyChildhoodCareAndEducation_2008.pdf.

Hägglund, S., & Pramling Sammuelson, I. (2009). Early childhood education and learning for sustainable development and citizenship. *International Journal of Early Childhood*, *41*(2), 41-49. https://doi.org/10.1007/BF03168878.

Heckman, J. J. (2008). Schools, skills, and synapses. *Economic Inquiry*, *46*(3), 289-324. https://doi.org/10.1111/j.1465-7295.2008.00163.x.

Heckman, J. (2011). The value of early childhood education. *American Educator*, *35*(1), 31-35, 47. Retrieved from https://files.eric.ed.gov/fulltext/EJ920516.pdf.

Hicks, J. R., & Allen, R. G. D. (1934a). A reconsideration of the theory of value, part I. *Economica*, New Series, *1*(1), 52-76. Retrieved from: http://www.jstor.org/stable/2548574.

Hicks, J. R., & Allen, R. G. D. (1934b). A reconsideration of the theory of value, part II. A mathematical theory of individual demand functions. *Economica*, New Series, *1*(2), 196-219. Retrieved from: http://www.jstor.org/stable/2548749.

Hohberg, M., Landau, K., Kneib, T., Klasen, S., & Zucchini, W. (2018). Vulnerability to poverty revisited: Flexible modeling and better predictive performance. *The Journal of Economic Inequality*, *16*(3), 439-454. https://doi.org/10.1007/s10888-017-9374-6.

Hutchison, T. W. (1977). *Knowledge and ignorance in Economics*. Chicago: University Press.

ILO (2017). *Global estimates of child labour: Results and trends, 2012-2016*. Retrieved from http://www.ilo.org/wcmsp5/groups/public/@dgreports/@dcomm/documents/publication/wcms_575499.pdf.

ILO (2018). *World employment and social outlook: Trends 2018*. International Labour Organization. Retrieved from http://www.ilo.org/wcmsp5/groups/public/---dgreports/---dcomm/---publ/documents/publication/wcms_615594.pdf.

INEC-CR (2015). *Índice de pobreza multidimensional (IPM): metodología*. Costa Rica. Instituto Nacional de Estadística y Censos. Retrieved from http://www.inec.go.cr/sites/default/files/documentos/pobreza_y_presupuesto_de_hogares/pobreza/metodologias/mepobrezaenaho2015-01.pdf.

INEC-NI (2003). *Perfil comparativo de la pobreza en Nicaragua 1993-1998-2001*. Instituto Nacional de Estadísticas y Censos (INEC), Managua, [online] http://www.inide.gob.ni/bibliovirtual/publicacion/comppobreza.pdf.

INEC-NI (2002a). *Perfil y características de los pobres en Nicaragua 2001*. Instituto Nacional de Estadísticas y Censos (INEC), Managua, [online] http://www.inide.gob.ni/bibliovirtual/publicacion/perfil01.pdf.

INEC-NI (2002b). *Informe general. Encuesta Nacional sobre Medición de Nivel de Vida, 2001*. Instituto Nacional de Estadísticas y Censos (INEC), Managua, [online] http://www.inide.gob.ni/bibliovirtual/publicacion/infgeneral.pdf.

INEC-NI (2006). *Encuesta Nacional de Hogares sobre Medición de Nivel de Vida 2005. Informe de metodología y operaciones*. Instituto Nacional de Estadísticas y Censos (INEC), Managua, [online] http://siteresources.worldbank.org/INTLSMS/Resources/3358986-1181743055198/3877319-1221830002534/InforMetod_EMNV05.pdf.

INIDE (2007). *Perfil y características de los pobres en Nicaragua (Encuesta de Hogares sobre Medición de Nivel de Vida 2005)*. Instituto Nacional de Información de Desarrollo (INIDE) Managua.

INIDE (2010). *Encuesta Nacional de Hogares sobre Medición de Niveles de Vida 2009, EMNV'09. Manual del usuario de la base de datos*, Instituto Nacional de Información de Desarrollo (INIDE), Managua, [online] http://www.inide.gob.ni/Emnv09/MANUAL_EMNV09.pdf.

INIDE (2011a). *Encuesta de Hogares sobre Medición del Nivel de Vida 2009 (EMNV'2009). Principales resultados: Pobreza, consumo, ingreso*. Instituto Nacional de Información de Desarrollo (INIDE), Managua, [online] http://www.inide.gob.ni/Emnv/Informe%20EMNV%202009.pdf.

INIDE (2011b). *Encuesta de Hogares sobre Medición del Nivel de Vida 2009 (EMNV 2009). Aspectos metodológicos*. Instituto Nacional de Información de Desarrollo (INIDE), Managua, [online] http://www.inide.gob.ni/Emnv09/Aspectos_Metodologicos.pdf.

INIDE (2015). *Results of the National Households Survey on Measurement of Level of Life, 2014*. Instituto Nacional de Información de Desarrollo (INIDE). Retrieved from http://www.inide.gob.ni/Emnv/Emnv14/Poverty%20Results%202014.pdf.

INIDE (2016). *La pobreza en Nicaragua – EMNV 2014*. Instituto Nacional de Información de Desarrollo (INIDE). Retrieved from http://www.inide.gob.ni/Emnv/Emnv14/EMNV%202014-2%20Febrero%202016.pdf.

Jain, R. (2012). Providing safe drinking water: A challenge for humanity. *Clean Technologies and Environmental Policy*, *14*(1), 1-4. https://doi.org/10.1007/s10098-011-0446-1.

Jenkins, S. (1991). Poverty measurement and the within-household distribution: Agenda for action. *Journal of Social Policy*. *20*(4), 457-483. https://doi.org/10.1017/S0047279400019760.

Jenkins, S. P., & Lambert, P. J. (1997). Three 'I's of poverty curves, with an analysis of UK poverty trends. *Oxford Economic Papers*, *49*(3), 317-327. https://doi.org/10.1093/oxfordjournals.oep.a028611.

Kakwani, N., & Silber, J. (2008a). *The many dimensions of poverty*. London: Palgrave-Macmillan.

Kakwani, N., & Silber, J. (2008b). *Quantitative approach to multidimensional poverty*. London: Palgrave-Macmillan.

Kaplan, C. (2010). Indoor air pollution from unprocessed solid fuels in developing countries. *Reviews of Environ Health*, *25*(3), 221-242. https://doi.org/10.1515/REVEH.2010.25.3.221.

Klasen, S. (1999). Does gender inequality reduce growth and development? Evidence from cross-country regressions. Policy Research Report Working Paper 7, World Bank, Washington, DC. Retrieved from http://documents.worldbank.org/curated/en/612001468741378860/pdf/multi-page.pdf.

Klasen, S. (2000). Measuring poverty and deprivation in South Africa. *Review of Income and Wealth*, *46*(1), 33-58. https://doi.org/10.1111/j.1475-4991.2000.tb00390.x.

Klasen, S. (2002). Low schooling for girls, slower growth for all? Cross-country evidence on effect of gender inequality in education on economic development. *The World Bank Economic Review*, *16*(3), 345-373. https://doi.org/10.1093/wber/lhf004.

Klasen, S (2006). Gender and pro-poor growth. In L. Menkoff (Ed.), *Pro-poor growth: Policy and evidence* (pp. 151-171). Berlin: Dunker and Humblot.

Klasen, S. (2007). Gender-related indicators of well-being. In M. McGillivray (Ed.), *Human well-being. Concept and measurement* (pp. 167-192). New York, NY: Palgrave Macmillan.

Klasen, S. (2018). Human development indices and indicators: A critical evaluation. *Background Papers*, Human Development Reports, United Nations Development Programme. Retrieved from http://hdr.undp.org/sites/default/files/klasen_final.pdf.

Klasen, S., & Fleurbaey, M. (2018). Leaving no one behind: Some conceptual and empirical issues. CDP Background Papers, No. 44, Department of Economic & Social Affairs, United Nations. Retrieved from https://www.un.org/development/desa/dpad/wp-content/uploads/sites/45/publication/CDP_BP44_June_2018.pdf.

Klasen, S., & Lahoti, R. (2016). How serious is the neglect of intra-household inequality in multidimensional poverty indices? *Discussion Papers*, No. 200, Courant Research Centre, 'Poverty, Equity and Growth in Developing and Transition Countries; Statistical Methods and Empirical Analysis', Georg-August-Universität Göttingen.

Klasen, S., & Lamanna, F. (2009). The impact of gender inequality in education and employment on economic growth: New evidence for a panel of countries. *Feminist Economics*, *15*(3), 91-132. https://doi.org/10.1080/13545700902893106.

Klasen, S., Lechtenfeld, T. & Meier, K., & Rieckmann, J. (2012). Benefits trickling away: The health impact of extending access to piped water and sanitation in urban Yemen. *Journal of Development Effectiveness*, *4*(4), 537-565. https://doi.org/10.1080/19439342.2012.720995.

Klasen, S., Lechtenfeld, T., & Povel, F. (2015). A feminization of vulnerability? Female headship, poverty, and vulnerability in Thailand and Vietnam. *World Development*, *71*, 36-53. https://doi.org/10.1016/j.worlddev.2013.11.003.

Klasen, S., & Povel, F. (2013). Defining and measuring vulnerability: State of the art and new proposals. In S. Klasen & H. Waibel (Eds.), *Vulnerability to poverty: Theory, measurement and determinants* (pp. 17-47). London: Palgrave–Macmillan.

Klasen, S., & Waibel, H. (2013). Introduction and key messages. In S. Klasen & H. Waibel (Eds.), *Vulnerability to poverty: Theory, measurement and determinants* (pp. 1-14). London: Palgrave–Macmillan.

Klasen, S., & Wink, C. (2002). A turning point in gender bias in mortality? An update on the number of missing women. *Population and Development Review*, *28*(2), 285-312. https://doi.org/10.1111/j.1728-4457.2002.00285.x.

Klasen, S., & Wink, C. (2003). "Missing women": Revisiting the debate. *Feminist Economics*, *9*(2-3), 263-299. https://doi.org/10.1080/1354570022000077999.

Lemmi, A., & Betti, G. (2006). *Fuzzy set approach to multidimensional poverty measurement*. New York: Springer.

Lemmi, A., & Betti, G. (2013). *Poverty and social exclusion: New methods of analysis*. Oxford: Routledge.

Liu, C., Esteve, A. & Trevino, R. (2017). Female-headed households and living conditions in Latin America, *World Development*, *90*, 311-328. https://doi.org/10.1016/j.worlddev.2016.10.008.

Lustig, N. (2011). Multidimensional indices of achievements and poverty: What do we gain and what do we lose? An introduction to JOEI Forum on multidimensional poverty. *The Journal of Economic Inequality*, *9*(2), 227-234. https://doi.org/10.1007/s10888-011-9186-z.

Mara D., & Evans, B. (2018). The sanitation and hygiene targets of the sustainable development goals: scope and challenges. *Journal of Water Sanitation and Hygiene for Development*, *8*(1), 1-16. https://doi.org/10.2166/washdev.2017.048.

Mara, D., Lane, J., Scott, B., & Trouba, D. (2010). Sanitation and health. *PloS Med*, *7*(11), 1-7. https://doi.org/10.1371/journal.pmed.1000363.

MEF (2017). *Índice de pobreza multidimensional de Panamá - año 2017*. Ministerio de Economía y Finanzas, República de Panamá. Retrieved from http://www.mef.gob.pa/es/informes/Documents/Informe%20del%20Indice%20de%20Pobreza%20Multidimensional%20de%20Panama%202017.pdf.

Mc Lanahan, S. S., Sørensen, A., & Watson, D. (1989). Sex Differences in Poverty, 1950-1980. *Signs: Journal of Women in Culture and Society*, *15*(1), 102-122. Retrieved from http://www.jstor.org/stable/pdf/3174708.pdf.

Ministerio de Desarrollo Social (2016). Metodología de medición de la pobreza multidimensional con entorno y redes. *Serie Documentos Metodológicos* CASEN No 32. Retrived from http://observatorio.ministeriodesarrollosocial.gob.cl/casen-multidimensional/casen/docs/Metodologia_de_Medicion_de_Pobreza_Multidimensional.pdf.

Mitra, S., Posarac, A., & Vick, B. (2013). Disability and poverty in developing countries: A multidimensional study. *World Development*, *41*, 1-18. https://doi.org/10.1016/j.worlddev.2012.05.024.

Nathanson, C. A. (1975). Illness and the feminine role: A theoretical review. *Social Science & Medicine*, *9*(2), 57-62. https://doi.org/10.1016/0037-7856(75)90094-3.

Noga, J., & Wolbring, G. (2013). Perceptions of water ownership, water management, and the responsibility of providing clean water. *Water*, *5*(4), 1865-1889. https://doi.org/10.3390/w5041865.

Noorbakhsh, F. (1998). The human development index: Some technical issues and alternative indices. *Journal of International Development*, *10*(5), 589-605. https://doi.org/10.1002/(SICI)1099-1328(199807/08)10:5%3C589::AID-JID484%3E3.0.CO;2-S.

Nores, M., & Barnett, W.S. (2010). Benefits of early childhood interventions across the world: (Under) Investing in the very young. *Economics of Education Review*, *29*(2), 271-282. https://doi.org/10.1016/j.econedurev.2009.09.001.

Nussbaum, M. (2003). Capabilities as fundamental entitlements: Sen and social justice. *Feminist Economics*, *9*(2-3), 33-59. https://doi.org/10.1080/1354570022000077926.

OHCHR (2009). The right to adequate housing. *Fact Sheet No. 21* (Rev. 1). Office of the United Nations High Commissioner for Human Rights, Geneva: United Nations. Retrieved from http://www.ohchr.org/Documents/Publications/FS21_rev_1_Housing_en.pdf.

OPHI (2015). Multidimensional poverty index 2015+. *Briefing Document*, Oxford Poverty & Human Development Initiative, University of Oxford. Retrieved from https://www.ophi.org.uk/wp-content/uploads/Multidimensional-Poverty-Index-2015-2-March-2015.pdf.

OPHI (2018). *Global multidimensional poverty index 2018. The most detailed picture to date of the world's poorest people*. Oxford Poverty & Human Development Initiative (OPHI), University of Oxford, UK. Retrieved from https://ophi.org.uk/wp-content/uploads/G-MPI_2018_2ed_web.pdf.

Pogge, T., & Wisor, S. (2016). Measuring poverty: A proposal. In M. Adler & M. Fleurbaey (Eds.), *The Oxford handbook of well-being and public policy* (pp. 645-676). Oxford: Oxford University Press.

Pramling Samuelson, I. (2011). Why we should begin early with ESD: The role of early childhood education. *International Journal of Early Childhood*, *43*(2), 103-118. https://doi.org/10.1007/s13158-011-0034-x.

Pramling Samuelsson, I., & Kaga, Y. (2010). Early childhood education to transform cultures for sustainability. In The Worldwatch Institute (57-61), 2010 state of the world. Transforming cultures. From consumerism to sustainability.

Pritchett, L., Suryahadi, A., & Sumarto, S. (2000). Quantifying vulnerability to poverty: a proposed measure, applied to Indonesia. *Policy Research Working Paper*, No. 2437, The World Bank, East Asia and Pacific Region, Evironment and Socal Development Sector Unit, Washington, DC. Retrieved from https://openknowledge.worldbank.org/bitstream/handle/10986/21355/wps2437.pdf;sequence=1.

Ravallion, M. (2011). On multidimensional indices of poverty. *The Journal of Economic Inequality*, *9*(2), 235-248. https://doi.org/10.1007/s10888-011-9173-4.

Ray, D. (1998). *Development economics*. Princeton, New Jersey: Princeton University Press.

Ray, R., & Sinha, K (2015). Multidimensional deprivation in China, India and Vietnam: A comparative study on micro data. *Journal of Human Development and Capabilities*, *16*(1), 69-93. https://doi.org/10.1080/19452829.2014.897311.

Rippin, N. (2010). Poverty severity in a multidimensional framework: The issue of inequality between dimensions. *Discussion Papers*, *47*. Courant Research Centre, 'Poverty, Equity and Growth in Developing and Transition Countries; Statistical Methods and Empirical Analysis', Georg-August-Universität Göttingen.

Rippin, N. (2012). Distributional justice and efficiency: Integrating inequality within and between dimensions in additive poverty indices. *Discussion Papers*, *128*. Courant Research Centre, 'Poverty, Equity and Growth in Developing and Transition Countries; Statistical Methods and Empirical Analysis', Georg-August-Universität Göttingen.

Rippin, N. (2013). *Considerations of Efficiency and Distributive Justice in Multidimensional Poverty Measurement*. Doctoral Dissertation. George-August-Universität Göttingen, Germany. Retrieved from https://www.die-gdi.de/uploads/media/Rippin_Efficiency_and_Distributive_Justice_Online_Publication.pdf.

Rippin, N. (2016). Multidimensional poverty in Germany: A capability approach. *Forum for Social Economics*, *45*(2-3), 230-255. https://doi.org/10.1080/07360932.2014.995199.

Rippin, N. (2017). Efficiency and distributive justice in multidimensional poverty issues. In R. White (Ed.), *Measuring multidimensional poverty and deprivation. Incidence and determinants in developed countries* (pp. 31-67). https://doi.org/10.1007/978-3-319-58368-6.

Robeyns, I. (2003). Sen's capability approach and gender inequality: Selecting relevant capabilities. *Feminist Economics*, *9*(2-3), 61-92. https://doi.org/10.1080/1354570022000078024.

Robeyns, I. (2006). Three models of education: Rights, capabilities and human capital. *Theory and Research in Education*, *4*(1), 69-84. http://dx.doi.org/10.1177/1477878506060683.

Roche, J. M. (2013). Monitoring progress in child poverty reduction: Methodological insights and illustration to case study of Bangladesh. *Social Indicators Research*, *112*(2), 363-390. https://doi.org/10.1007/s11205-013-0252-8.

Roche, J. M., & Santos, M. E. (2012). In search of a multidimensional poverty index for Latin America. Paper presented at 5th ECINEQ Meeting, 2-24 July 2013, Bari, Italy, [online] http://www.ecineq.org/ecineq_bari13/FILESxBari13/CR2/p170.pdf.

Rodríguez, L. (2016). Intrahousehold inequalities in child rights and well-Being. A barrier to progress? *World Development*, *83*, 111-134. https://doi.org/10.1016/j.worlddev.2016.02.005.

Roelen, K., Gassmann, F., & de Neubourg, C. (2010). Child poverty in Vietnam: Providing insights using a country-specific and multidimensional model. *Social Indicators Research*, *98*(1), 129-145. https://doi.org/10.1007/s11205-009-9522-x.

Roelen, K., Gassmann, F., & de Neubourg, C. (2011). False positives or hidden dimensions: What can monetary and multidimensional measurement tell us about child poverty in Vietnam? *International Journal of Social Welfare*, *21*(4), 393-407. https://doi.org/10.1111/j.1468-2397.2011.00836.x.

Rogan, M. (2013). Poverty and headship in post-apartheid South Africa, 1997-2006. *Social Indicators Research*, *113*(1), 491-511. https://doi.org/10.1007/s11205-012-0107-8.

Rogan, M. (2016a). Gender and multidimensional poverty in South Africa: Applying the global multidimensional poverty index (MPI). *Social Indicators Research*, *126*(3), 987-1006. https://doi.org/10.1007/s11205-015-0937-2.

Rogan, M. (2016b). Qualitative perceptions of the meaning of "headship" and female-headed households in post-apartheid South Africa. *Social Dynamics*, *42*(1), 175-195. https://doi.org/10.1080/02533952.2016.1166550.

Rosati, F. C., & Rossi, M. (2003). Children's working hours and school enrollment: Evidence from Pakistan and Nicaragua. *The World Bank Economic Review*, *17*(2), 283-295. https://doi.org/10.1093/wber/lhg023.

Santos, M. E. (2013). Tracking poverty reduction in Buthan: Income deprivation alongside deprivation in other sources of happiness. *Social Indicators Research*, *112*(2), 259-290. https://doi.org/10.1007/s11205-013-0248-4.

Santos, M.E., Lugo, M. A., López-Calva, L. F., Cruces, G., & Battistón, D. (2015). Refining the basic needs approach: A multidimensional analysis of poverty in Latin America. In *Studies in applied welfare analysis: Papers from the third ECINEQ meeting* (1-29). https://doi.org/10.1108/S1049-2585(2010)0000018004.

Santos, M.E., & Ura, K. (2008). Multidimensional poverty in Bhutan: Estimates and policy implications. *OPHI Working Paper*, No. 15, Oxford, Oxford Poverty and Human Development Initiative, University of Oxford. Retrieved from https://www.ophi.org.uk/wp-content/uploads/OPHI-wp14.pdf.

Santos, M. E., & Villatoro, P. (2018). A multidimensional poverty index for Latin America. *Review of Income and Wealth*, *64*(1), 52-82. https://doi.org/10.1111/roiw.12275.

SCGG-INE (2016). *Medición multidimensional de la pobreza (2016). Honduras*. Secretaría de Coordinación General de Gobierno (SCGG) y El Instituto Nacional de Estadísticas (INE). Retrieved from http://www.scgg.gob.hn/ipm/assets/ipm.pdf.

Sen, A. (1976). Poverty: An ordinal approach to measurement. *Econometrica*, *44*(2), 219-231. Retrieved from http://www.jstor.org/stable/1912718.

Sen, A. (1979). Issues in the measurement of poverty. *The Scandinavian Journal of Economics*, *81*(2), 285-307. Retrieved from http://www.jstor.org/stable/3439966.

Sen, A. (1984). The living standard. *Oxford Economic Papers*, *36*, 74-90. Retrieved from http://www.jstor.org/stable/pdf/2662838.pdf.

Sen, A. (1985). *Commodities and capabilities*. Netherlands: North-Holland.

Sen, A. (1992). *Inequality reexamined*. Cambridge, MA: Harvard University Press.

Sen, A. (1993). Capability and well-being. In M. Nussbaum & A. Sen (Eds.), *The quality of life* (pp. 30-53). Oxford: Clarendon Press.

Sen, A. (1997). *On economic inequality*. Oxford: Oxford University Press.

Sen, A.K. (1999). A Plan for Asia's growth. Build on much that is good in the 'Eastern strategy'. *AsiaWeek*, October 8, *25*(40). Retrieved from http://edition.cnn.com/ASIANOW/asiaweek/magazine/99/1008/viewpoint.html.

Sen, A. (2000a). *Development as freedom*. New York: First Anchor Books Edition.

Sen, A. (2000b). A decade of human development. *Journal of Human Development*, *1*(1), 17-23. https://doi.org/10.1080/14649880050008746.

Sen, A. (2008). The economics of happiness and capability. In L. Bruni, F. Comim & M. Pugno (Eds.), *Capability and happiness* (16-27). Oxford: Oxford University Press.

Sen, A. (2010). *The idea of justice*. London: Penguin Books.

Shaw, M. (2004). Housing and public health. *Annual Review of Public Health*, *25*, 397-418. https://doi.org/10.1146/annurev.publhealth.25.101802.123036.

Silber, J. (2007). Measuring poverty: Taking a multidimensional perspective. *Hacienda Pública Española/Revista de Economía Pública*, *182*(3/2007), 29-73.

Silber, J. (2011). A comment on the MPI index. *The Journal of Economic Inequality*, *9*, 479-481. https://doi.org/10.1007/s10888-011-9198-8.

Silber, J., & Yalotnezky, G. (2014). Measuring multidimensional deprivation with dichotomized and ordinal variables. In G. Betti & A. Lemmi (Eds.), *Poverty and social exclusion: New methods of analysis*, (9-37). Oxford: Routledge.

Sorenson, S. B, Morssink, C., & Campos, P. A. (2011). Safe access to safe water in low income countries: Water fetching in current times. *Social Science & Medicine*, *72*(9), 1522-1526. https://doi.org/10.1016/j.socscimed.2011.03.010.

Stiglitz, J., Sen, A. & Fitoussi, J-P (2009a). *Report by the commission on the measurement of economic performance and social progress*. Retrieved from http://www.insee.fr/fr/publications-et-services/dossiers_web/stiglitz/doc-commission/RAPPORT_anglais.pdf.

Stiglitz, J., Sen, A. & Fitoussi, J-P (2009b). The Measurement of Economic Performance and Social Progress Revisited - Reflections and Overview. *OFCE Working Paper*, No. 2009-33, Centre de Recherche en Économie de Sciences Po. Retrieved from http://spire.sciencespo.fr/hdl:/2441/5l6uh8ogmqildh09h4687h53k/resources/wp2009-33.pdf.

STPP & MINEC-DIGESTYC (2015). *Medición multidimensional de la pobreza. El Salvador*. San Salvador: Secretaría Técnica y de Planificación de la Presidencia y Ministerio de Economía, a través de la Dirección de Estadística y Censos. Retrieved from http://www.secretariatecnica.gob.sv/wp-content/uploads/2015/10/Medici%C3%B3n-Multidimensional-de-la-Pobreza-El-Salvador.pdf.

Suryahadi, A., & Sumarto, S. (2003). Poverty and vulnerability in Indonesia before and after the economic crisis. *Asian Economic Journal*, *17*(1), 45-64. https://doi.org/10.1111/1351-3958.00161.

Thorbecke, E. (2008). Multidimensional poverty: Conceptual and measurement issues. In N. Kakwani & J. Silber (Eds.), *The many dimensions of poverty* (3-19). London: Palgrave-Macmillan.

Thorbecke, E. (2011). A comment on multidimensional poverty indices. *The Journal of Economic Inequality*, *9*, 485-487. https://doi.org/10.1007/s10888-011-9199-7.

Trommlerová, S. K., Klasen, S., & Leßmann, O. (2015). Determinants of empowerment in a capability-based poverty approach: Evidence from The Gambia. *World Development*, *66*, 1-15. http://dx.doi.org/10.1016/j.worlddev.2014.07.008.

Tsui, K-y. (2002). Multidimensional poverty indices. *Social Choice and Welfare*, *19*(1), 69-93. https://doi.org/10.1007/s355-002-8326-3.

UN (1989). *Convention on the rights of the child. United nations human rights*. Office of the High Commissioner. Retrieved from http://www.ohchr.org/Documents/ProfessionalInterest/crc.pdf.

UN (2015a). *The Millennium Development Goals Report 2015*. Retrieved from http://www.undp.org/content/dam/undp/library/MDG/english/UNDP_MDG_Report_2015.pdf.

UN (2015b). *Resolution adopted by the General Assembly on 25 September 2015*. United Nations General Assembly A/RES/70/1, Seventieth Session, Agenda items 15 and 116. Retrieved from http://www.un.org/ga/search/view_doc.asp?symbol=A/RES/70/1&Lang=E.

UNDP (2010). *Human development report 2010. The real wealth of nations: Pathways to human development*. New York, N. Y.: United Nations Development Program. Retrieved from http://hdr.undp.org/sites/default/files/reports/270/hdr_2010_en_complete_reprint.pdf.

UNDP (2011). *Informe nacional sobre desarrollo humano 2011. Las juventudes construyendo Nicaragua*. United Nations Development Programme, Managua, Nicaragua [online] http://hdr.undp.org/sites/default/files/reports/245/nicaragua_indh_2011.pdf.

UN (2017). *Resolution adopted by the General Assembly on 06 July 2017*. United Nations General Assembly A/RES/71/313, Seventy-first Session, Agenda items 13 and 117. Retrieved from http://ggim.un.org/meetings/2017-4th_Mtg_IAEG-SDG-NY/documents/A_RES_71_313.pdf.

Vijaya, R. M., Lahoti, R., & Swaminathan, H. (2014). Moving from the household to the individual: Multidimensional poverty analysis. *World Development*, *59*, 70-81. https://doi.org/10.1016/j.worlddev.2014.01.029.

Villatoro, P. (2007). Propuesta de ampliación del segundo objetivo de desarrollo del milenio: Un estado de avance. *CEPAL – Serie Estudios Estadísticos y Prospectivos No. 62*. Naciones Unidas, Santiago de Chile. Retrieved from http://repositorio.cepal.org/bitstream/handle/11362/4765/S0701108_es.pdf;jsessionid=BA383D4D1FEFBC6F1BC6040FC21E592C?sequence=1.

Whelan, C. T., Nolan, B., & Maître, B. (2014). Multidimensional poverty measurement in Europe: An application of the adjusted headcount ratio. *Journal of European Social Policy*, *24*(2), 183-197. https://doi.org/10.1177/0958928713517914.

Wiepking, P., & Maas, I. (2005). Gender differences in poverty: A cross-national study. *European Sociological Review*, *21*(3), 187-200. https://doi.org/10.1093/esr/jci021.

World Bank (2017). *Monitoring global poverty: Report of the commission on global poverty*. Washington DC: World Bank. https://doi.org/10.1596/978-1-4648-0961-3.

WBI (2005). *Introduction to poverty analysis*. Washington, D.C.: World Bank Institute. Retrieved from http://siteresources.worldbank.org/PGLP/Resources/PovertyManual.pdf.

World Economic Forum (2017). The global gender gap report 2017. Retrieved from http://www3.weforum.org/docs/WEF_GGGR_2017.pdf.

Wiepking, P., & Maas, I. (2005). Gender differences in poverty: A cross-national study. *European Sociological Review*, *21*(3), 187-200. https://doi.org/10.1093/esr/jci021.

Yalonetzky, G. (2012). Conditions for the most robust multidimensional poverty comparisons using counting measures and ordinal variables. ECINEQ Working Paper Series, WP 2012-257. Society for the Study of Economic Inequality (ECINEQ). Retrieved from http://www.ecineq.org/milano/wp/ecineq2012-257.pdf.

Yalonetzky, G. (2014). Conditions for the most robust multidimensional poverty comparisons using counting measures and ordinal variables. *Social Choice and Welfare*, *43*(4), 773-807. https://doi.org/10.1007/s00355-014-0810-2.